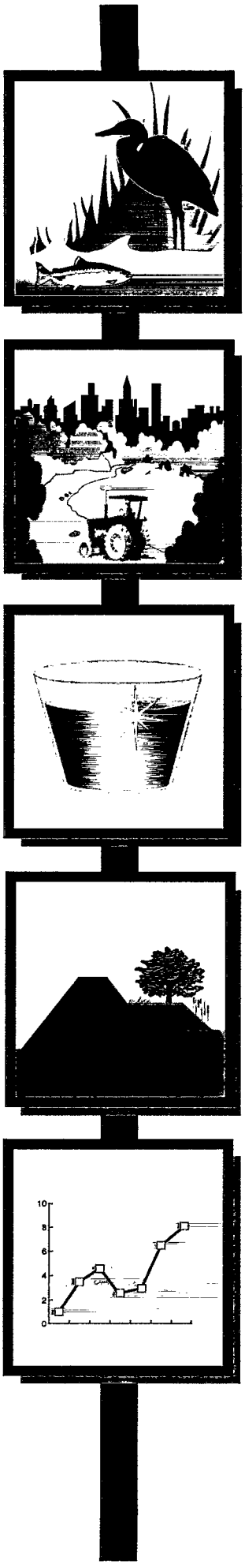

CALFED
BAY-DELTA
PROGRAM

Attachment 6a

Programmatic Endangered Species Act Section 7 Biological Opinions U.S. Fish and Wildlife

August 28, 2000

A-000349

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Sacramento Fish and Wildlife Office
2800 Cottage Way, Room W-2605
Sacramento, California 95825

IN REPLY REFER TO:
1-1-00-F-184

August 28, 2000

Memorandum

To: Regional Director, U.S. Bureau of Reclamation, Mid Pacific Region
Sacramento, California

From: Field Supervisor, Sacramento Fish and Wildlife Office
Sacramento, California

Subject: Reinitiation of Programmatic Formal Consultation and Conference on the CALFED Bay-Delta Program (File No. 1-1-F-00-183)

This document transmits the Fish and Wildlife Service's (Service) programmatic biological and conference opinions based on the Service's review of the CALFED Bay-Delta Program (CALFED Program) and its effects on listed species and critical habitats in California. These opinions are provided in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act)(16 U.S.C. 1531 et seq.). The Service originally concluded formal consultation on the CALFED Program on August 23, 2000. The CALFED Agencies requested reinitiation of formal consultation on August 28, 2000, to clarify language within the project description.

These biological and conference opinions are based primarily on information provided in: (1) the July 2000, Multi-Species Conservation Strategy; (2) the July 2000 Final Programmatic EIS/EIR for the CALFED Bay-Delta Program and its Technical Appendices; (3) the Environmental Water Account Operating Principles Agreement in Appendix E; (4) additional information contained in Service files. A complete administrative record of this consultation is on file in this office.

Wayne S. White

Attachment

A-000350

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Introduction

This biological opinion addresses implementation of the CALFED Bay-Delta Program (CALFED Program). The CALFED Program was developed collaboratively by 18 Federal and State agencies (CALFED Agencies) with management and regulatory responsibilities affecting the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta). The co-lead agencies for the purposes of this biological opinion are the Bureau of Reclamation (Reclamation), Fish and Wildlife Service (Service), Bureau of Land Management (BLM), Geological Survey (USGS), Army Corps of Engineers (Corps), Environmental Protection Agency (EPA), National Marine Fisheries Service (NMFS), Natural Resources Conservation Service (NRCS), Forest Service (USFS), and Western Area Power Administration (WAPA). The State of California's Resources Agency is an applicant for the purposes of this consultation, and represents the California Department of Fish and Game (CDFG), Department of Water Resources (DWR) and the Reclamation Board.

CALFED Program implementation, in conjunction with the MSCS and programmatic biological opinions, will provide benefits in subsequent site specific consultations. Specifically, individual projects that qualify for consultation will be evaluated within the context of the program as a whole, which includes major elements designed to improve the environmental baseline and lead to the recovery of targeted species. These major elements will be subject to on-going monitoring, evaluation, and the application of adaptive management. Project specific biological opinions will take into account the environmental benefits that accrue from the CALFED Program. As a result, the Service and NMFS anticipate that implementation of the overall CALFED program will streamline the ESA compliance process, and benefits to listed species will reduce the need for additional provisions to satisfy legal requirements.

The CALFED Program is described in the main document of the Programmatic Environmental Impact Statement/Programmatic Environmental Impact Report (PEIS/PEIR), its technical appendices for program plans and strategies, and in its Implementation Plan and Phase II report. The **Description of the Proposed Action** in this programmatic biological opinion is based on these documents. Thus, the **Description of the Proposed Action** provides clarifications and details derived from the various documents comprising the PEIS/PEIR and is intended to provide a comprehensive description of the CALFED Program.

The PEIS/PEIR is a National Environmental Policy Act (NEPA) document that allows for future, tiered, site-specific NEPA analysis on CALFED Program actions. This programmatic biological opinion provides for a similar tiering process. Discrete CALFED Program actions will submit to tiered review under section 7 of the Federal Endangered Species Act (ESA), where appropriate.

The Multi-Species Conservation Strategy (MSCS) facilitates this process by describing a process for developing Action-Specific Implementation Plans (ASIP) consistent with the CALFED Program and ESA; and programmatic measures to avoid, minimize, and compensate for impacts to listed and proposed species, and species of special concern.

The CALFED Program has several programs designed to further the purposes of ESA. These programs are an inseparable part of the CALFED Program, and include the Ecosystem Restoration Program (ERP), MSCS, Water Quality Program (WQP), Environmental Water Account (EWA) and its Operating Principles, and implementation strategies including monitoring and adaptive management. Commitments to uphold the ESA by CALFED Agencies, combined with implementation of the programs and commitments as described in the **Description of the Proposed Action**, contributed to the Service's decision-making process leading to a **Conclusion** of no jeopardy or adverse modification. The no-jeopardy conclusion at this programmatic scale is not intended to, and does not, preclude the Service from making a future jeopardy determination for a project-specific action, based on the effects analysis. However, the (1) monitoring and adaptive management, (2) communication, cooperation, and outreach, (3) agency commitments regarding conservation, restoration, compensation, and commitments to work together to recover listed species, and (4) project-specific consultation all diminish the likelihood of future jeopardy opinions tiered under this programmatic biological opinion.

This consultation is intended to address in a comprehensive manner the numerous and widely varied actions related to the implementation of the CALFED Program. While CALFED Program actions are clearly interrelated and interdependent, many actions implemented by the various CALFED Agencies are not and should not be considered as stand alone actions. Nevertheless, the Service and NMFS have agreed with the other CALFED Agencies that to facilitate ESA compliance, the activities that are listed in the **Description of the Proposed Action** would be evaluated as a suite of actions all related in one form or another to the CALFED Program. Therefore, this biological opinion addresses the effects upon listed species resulting from the implementation of this suite of actions as a whole and also provides a strategy, or process, as to how ESA compliance on the individual activities that cumulatively make up the CALFED Program will be accomplished.

A number of key program actions related to the implementation of a variety of activities, especially those related to addressing the needs of listed species, are considered in developing this biological opinion at the programmatic level. These key program actions are critical to the overall determination of how implementation of this suite of actions may, or may not jeopardize listed species because the effects of the actions are evaluated in the aggregate. If key program actions are not implemented at this programmatic level, or new information becomes available,

consultation would be reinitiated at the programmatic level to ascertain how the lack of implementation of any action(s), or new information, affects the evaluation of effects upon listed species associated with the overall implementation of the suite of actions being considered and the subsequent conclusions made in this biological opinion.

The project-specific or tiered consultations that will follow this programmatic consultation will rely on implementation of the key program actions to direct the development and implementation of the project-specific actions. If the CALFED Program fails to implement conservation measures or if new information becomes available, reinitiation on the programmatic level may be necessary.

The Service and other CALFED Agencies have consulted on numerous large-scale projects and plans that impact species protected under the ESA. The results of these consultations have been biological opinions that stand on their own merits, establish thresholds to ensure survival and recovery of listed species, and establish a baseline for the effects considered by subsequent consultations. Of particular note are: the Service's October 15, 1991, biological opinion on the Friant Water Contract Renewals (Friant, Service file #1-1-91-F-22); the Service's December 27, 1994, biological opinion on Interim Water Contract Renewal (Interim, Service file #1-1-94-F-69); the Service's November 2, 1994, biological opinion on the Environmental Protection Agency's Water Quality Standards for the San Francisco Bay/Sacramento-San Joaquin Rivers and Delta (Service file #1-1-93-F-61), the Service's March 6, 1995, biological opinion on Reclamations's Long-term Operations Criteria and Plan [(OCAP), Service file #1-1-94-F-70]; and the Service's opinions on the Los Vaqueros Project—in particular the September 9, 1993, opinion (Los Vaqueros, Service file #1-1-93-F-35). This biological opinion is based on the understanding that the thresholds identified in those earlier opinions are a part of the baseline for this consultation. Actions that are not consistent with the project description in this document have not been analyzed for their impacts on the survival and recovery of listed and proposed species.

To implement long-range planning and to assure efficient and effective implementation of the CALFED Program and ESA, the CALFED Agencies, which includes the Service, NMFS, and CDFG (Fish and Wildlife Agencies), will continue coordination on: (1) development of ASIPs for future tiered CALFED Program actions; (2) identification and implementation of conservation actions needed to minimize the impact of the CALFED Program on listed species; and (3) continually monitoring, evaluating, and adapting the program based upon new information.

Although this document is intended to dovetail with the NEPA process, it should be noted that Categorical Exclusions from NEPA are not exempt from compliance with the ESA. The ESA guidance in this opinion is intended to be followed based on effects to listed species. Any ancillary or exclusionary language from laws other than the ESA should not be used to bear upon

any effects determinations that are made relative to listed species.

Numerous acronyms are used for actions and projects within the CALFED Program. In this document use of acronyms has been limited to those entities, acts, and descriptors that are referred to frequently. A list of these acronyms is provided on the following pages in Table 1.

Table 1. Acronyms used in this opinion

af	acre-feet
ASIP	Action Specific Implementation Plan
AWMC	Agricultural Water Management Council
BDAC	Bay-Delta Advisory Committee
BLM	U.S. Bureau of Land Management
BMP	best management practice
CALFED	Eighteen Federal and State agencies
CCA	candidate conservation agreements
CCWD	Contra Costa Water District
CDFG	California Department of Fish and Game
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cfs	cubic feet per second
CMARP	Comprehensive Monitoring, Assessment, and Research Program
CNPS	California Native Plant Society
Corps	U.S. Army Corps of Engineers
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
CVP-OCAP	Central Valley Project-Operations Criteria and Plan
CVPIA	Central Valley Project Improvement Act
CWA	Clean Water Act

DCC	Delta Cross Channel
DO	dissolved oxygen
E/I Ratio	Export-Inflow Ratio
EPA	U.S. Environmental Protection Agency
ERP	Ecosystem Restoration Program
ERPP	Ecosystem Restoration Program Plan
ESA	Federal Endangered Species Act
EWA	Environmental Water Account
FERC	Federal Energy Regulatory Commission
FONSI	Finding of No Significant Impact
FMWT	fall midwater trawl survey
Gap GIS	California Gap Analysis landcover geographic information system
GIS	geographic information system
HCP	Habitat Conservation Plan
IA	implementing agreement
ISI	integrated storage investigation
MAF	million acre-feet
"M" goal	maintain the species
MOU	Memorandum of Understanding
MSCS	Multi-Species Conservation Strategy
NCCP	Natural Community Conservation Plan
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOD	Notice of Determination
O&M	Operation and Maintenance
OCAP	Operations Criteria and Plan

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PG&E	Pacific Gas & Electric Company
pH	measure of acidity or alkalinity
PL	Public Law
PEIS/PEIR	Programmatic Environmental Impact Statement/ Programmatic Environmental Impact Report
ppb	parts per billion
ppm	parts per million
ppt	parts per thousand
"r" goal	contribute to recovery of the species
"R" goal	recovery of the species
Reclamation	U.S. Bureau of Reclamation
ROD	Record of Decision
Service or USFWS	U.S. Fish and Wildlife Service
SB	Senate Bill
SJRA	San Joaquin River Agreement
SRA	shaded riverine aquatic
SWP	State Water Project
SWRCB	State Water Resources Control Board
TAF	thousand acre-feet
TMDL	Total Maximum Daily Load
TOC	Total Organic Carbon
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
VAMP	Vernalis Adaptive Management Program
WAPA	Western Area Power Administration
WQCP	Water Quality Control Plan
WQP	Water Quality Program

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WUE	Water Use Efficiency Program

Study Area

The area addressed in this biological opinion (Appendix A) includes the legal Delta, Suisun Bay and Marsh, lands within the Central Valley watershed, the upper Trinity River watershed, the southern California water system service area, San Pablo Bay, and San Francisco Bay. The CALFED Program study area also includes portions of the Pacific Ocean out to the Farallon Islands, and a near-shore coastal zone that extends from about Morro Bay to the Oregon border. This latter area is not addressed in this biological opinion.

This biological opinion addresses the following three distinct geographic subareas:

- MSCS Focus Area. This area (Appendix A, Figures A-1 and A-2) includes the legally defined Delta, Suisun Bay and Marsh, the Sacramento and San Joaquin Rivers and their tributaries downstream of major dams, and the potential locations of reservoirs.

- Other Service Areas. This area (Appendix A, Figure A-1) includes other State Water Project (SWP) and Central Valley Project (CVP) service areas that are located outside of the MSCS Focus Area and the Watershed Program Area.

- Watershed Program Area. This area (Appendix A, Figure A-1) encompasses the entire upper watersheds of the Central Valley including those areas located above and below major dams and outside the MSCS Focus Area and other service areas, and a portion of the upper Trinity River watershed.

A total of 126 listed and proposed species occur or potentially occur in the MSCS focus area (Appendix B).

CONSULTATION HISTORY

The CALFED Program was initiated in May 1995 by then Governor Pete Wilson and the Clinton Administration to address environmental and water management problems associated with the Bay-Delta. In June 1995, State and Federal agencies launched a partnership to develop and implement a comprehensive, long-term management plan for the Bay-Delta. The management plan is intended to address problems of the Bay-Delta system within four critical, often competing, resource categories: ecosystem quality, water quality, levee system integrity, and water supply reliability. The CALFED Program officially involves the 18 CALFED Agencies with management or regulatory responsibilities in the Bay-Delta. Stakeholder input was facilitated through the Bay-Delta Advisory Committee (BDAC).

At its inception, the CALFED Program was divided into two planning phases (Phase I and II) and an implementation phase (Phase III). During Phase I, the CALFED Program concentrated on identifying and defining the problems confronting the Bay-Delta system. A mission statement and guiding principles were developed, along with CALFED Program objectives and an array of potential actions to meet them. Phase I was completed in September 1996.

During Phase II the CALFED Program developed a preferred program alternative (Preferred Program Alternative) and conducted a comprehensive programmatic environmental review process. Because the CALFED solution area is so large, and because it is approaching its task in an integrated, comprehensive way, environmental review must be conducted on a very broad level. Phase II ends following the signing of a Federal Record of Decision (ROD) and State Certification of the Final PEIS/PEIR. Phase III will begin with implementation of the CALFED Program. The CALFED Program solution plan is expected to take 30 years or more to complete.

Early in Phase I, from July 1995 to July 1996, the co-lead Federal CALFED Agencies held more than 30 public meetings and workshops around the State to involve Californians in developing a Bay-Delta solution. The participating Federal agencies included the NMFS, NRCS, Corps, Reclamation, EPA, and the Service. The problems of the Bay-Delta were defined and a range of alternative solutions was developed. Additionally, three preliminary alternatives for Delta water conveyance were identified for further analysis during Phase II. The first conveyance configuration relied primarily on the existing conveyance system, with some minor changes in the south Delta. The second configuration relied on enlarging channels within the Delta. The third configuration included in-channel modifications and a conveyance channel that would move some water around the Delta. Each of these alternatives also included new ground and surface water storage options. Proposed management actions were grouped into six CALFED Program elements (i.e., levee system integrity, water quality improvements, ecosystem restoration, water

use efficiency measures, water transfers, and watershed management). In February 1996, the CALFED Program released 20 draft alternative solutions, each including hundreds of actions to help solve the Bay-Delta problems.

CALFED Agencies participated on management and technical teams (e.g., the MSCS teams, and the Ecosystem Restoration Program [ERP] Focus Group) and contributed to several planning documents developed during Phase II, including the Draft (March 1998) and Final (July 2000) PEIS/PEIR; and Administrative Draft (March 31, 2000), Draft (April 17, 2000) and Final (July 2000) MSCS, which serves as the biological assessment for the CALFED Program section 7 consultation.

In June 1996, the list of alternatives was refined to three conceptual comprehensive approaches. In September 1996, the CALFED Agencies released the Phase I Final Report and launched a two-year environmental review of the conceptual alternative solutions. This action concluded Phase I of the CALFED Program and moved it into Phase II.

From June 1996 to December 1997, the CALFED Agencies held hundreds of public meetings to continue to involve the public in the process. Technical staff from various agencies worked with stakeholders to further refine the list of alternatives.

From March 1997 to November 1997, the CALFED Agencies released draft reports for four programs that were common to all of the alternatives. These draft reports included: the Ecosystem Restoration Program Plan, the Water Quality Component Report, the Water Use Efficiency Report, and the Delta Levee System Integrity Program Report.

In December 1997, more than $60 million in ecosystem restoration program projects were funded. This led to an additional $24 million in ecosystem restoration projects being funded in February 1998.

On March 16, 1998, the CALFED Agencies released a draft PEIS/PEIR containing the refined draft alternatives. The release was followed by a 105-day public comment period, which ended on July 1, 1998. Additionally, during the March 16, 1998 to July 1, 1998 time frame, the CALFED Agencies conducted further technical analyses to develop the draft Preferred Program Alternative, while also hosting public meetings, hearings, and workshops to continue to get public input.

In September 1998, another $25.5 million in ecosystem restoration projects were funded. In December 1998, the CALFED Agencies issued the Revised Phase II Report and draft framework plan for a Preferred Program Alternative.

On June 25, 1999, the CALFED Agencies released a revised draft PEIS/PEIR, which was followed by a 90-day comment period.

In July 2000, the CALFED Agencies released the final PEIS/PEIR which was followed by a 30-day comment period.

On August 18, 2000, the Service received a request for initiation from Reclamation, which is acting as the lead agency on behalf of all the Federal CALFED Agencies.

BIOLOGICAL AND CONFERENCE OPINIONS

Description of the Proposed Action

CALFED Bay-Delta Program

The CALFED Program is a long-term comprehensive plan to restore ecological health and improve water management for beneficial uses of the Bay-Delta system. The CALFED Program addresses issues in four general problem areas: ecosystem quality, water quality, water management, and levee system integrity. The following CALFED Program components were developed to solve issues in the problem areas:

- Levee System Integrity Program
- Water Quality Program
- Ecosystem Restoration Program
- Water Use Efficiency Program
- Water Transfer Program
- Watershed Program
- Storage
- Conveyance
- Environmental Water Account
- Science Program
- Multi-Species Conservation Strategy
- Governance

Most CALFED Program elements are described in technical appendices to the PEIS/PEIR. Storage and Conveyance are described separately. The EWA is an operational strategy intended to improve fish protection while not adversely affecting water supply.

All aspects of the CALFED Program are interrelated and interdependent. Ecosystem restoration is dependent upon supply and conservation. Supply is dependent upon water use efficiency and consistency in regulation. Water quality is dependent upon water use efficiency and consistency in regulations, improved conveyance, levee stability and healthy watersheds.

The CALFED Program includes a framework guiding implementation that addresses the scope, complexity, and duration of the CALFED Program, and the relative uncertainty regarding the CALFED Program's approach in resolving issues in the problem areas. Implementation is supported by an Implementation Plan that describes Stage 1 actions, CALFED Program integration, governance, and financing. In addition, a Science Program is included to carry out monitoring, assessment and research; and a MSCS will be followed to achieve compliance with the ESA. Implementation of the CALFED Program will be guided by an adaptive management approach with monitoring of performance to help modify (adapt) future actions and contribute to decision making. Also, the CALFED Program will be guided by the principle of balanced implementation of CALFED Program elements.

The term of this programmatic biological opinion includes Phase III of the CALFED Program (30 years or more), provided the CALFED Program remains in compliance with this programmatic biological opinion. The Service will evaluate the CALFED Program's consistency with this biological opinion at numerous points in the future, including:

- During review of annual reports submitted by the CALFED Program.
- During subsequent, tiered informal and formal consultation on ASIPs.
- After 4 years of implementation when sufficient data is collected and analyzed to fully evaluate the effectiveness of the WMS, together with other conservation elements, in meeting the conservation objectives of the CALFED Program.
- At the conclusion of Stage 1 to assess the Program's compliance in achieving the conservation objectives established in the CALFED "Milestones."

If the Service determines that the CALFED Program is not in compliance with this biological opinion, the CALFED Agencies will reinitiate this programmatic consultation. In addition, refer to the Reinitiation Statement in this consultation for further reasons for reinitiation.

The following sections describe the CALFED Program and its elements in greater detail.

Levee System Integrity Program

The Levee System Integrity Program's goal is to improve levees and levee management in the legal Delta and will investigate the level of levee work in Suisun Marsh, which together define its scope. All projects under the Levee System Integrity Program will be implemented to be fully consistent with other CALFED Program elements, including the ERP, Conveyance, and MSCS. Project-specific plans will incorporate appropriate elements of these other programs and strategies. Individual projects pursued under the Levee System Integrity Program, including each of the levee plans described below, will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA. The Levee System Integrity Program is comprised of the following five elements in the Delta, and a plan for Suisun Marsh levees:

Delta Levee Base Level Protection Plan. The CALFED Program will provide funding to participating local agencies in the Delta to reconstruct certain Delta levees to a uniform, base-level standard. The tentative standard is the Public Law (PL) 84-99 Delta Specific Standard (PL 84-99). Constructing levees to the PL 84-99 criteria is a prerequisite for, but not a guarantee of, post-flood Federal disaster assistance. This plan will evaluate the estimated 520 miles of non-Federal levees in the Delta and recommend levee segments that should conform with the Delta Specific Standard criteria. In addition, a funding mechanism will be established to support the routine inspection and maintenance of levees in the Delta, and for emergency response.

Delta Levee Special Improvement Projects. These projects will target areas that will provide flood protection above base-level standards for some islands protecting public benefits such as water quality, the ecosystem, life and personal property, agricultural production, cultural resources, recreation, and local and Statewide infrastructure. The scope of the Delta Levee Special Improvement Projects encompasses the Delta and levees bordering the northern Suisun Bay from Van Sickle Island to Montezuma Slough. Maintenance of upgraded levees will occur in conformance with specific criteria, consistent with meeting ERP objectives.

Delta Levee Subsidence Control Plan. The goal of this plan is to minimize the risk to levee integrity from land subsidence, in coordination with other CALFED Program elements. Measures will be implemented to reduce, eliminate, or reverse subsidence within a "zone of influence" (approximately 0-500 ft) adjacent to affected levees. Subsidence control techniques include:

- Geotechnical engineering principles and practices in conjunction with proven construction methods.
- Modifying seepage control, dewatering efforts, excavations, and land management activities near levees to best manage levee integrity.
- Strategically locating and constructing stability and drainage berms.
- Restricting practices such as land leveling, ditching, and certain other ground surface modifications within the zone of influence.
- Promoting high ground water levels and vegetation growth, where appropriate, to limit subsidence due to oxidation.

Delta Levee Emergency Management and Response Plan. The goals of this plan are to enhance existing emergency management response capabilities in the Delta, and to develop a stable funding source for emergency response. Future planning will concentrate on improving funding, resources, and response by State and Federal agencies; integrating response by all levels of government; clarification of regulatory procedures; and improving dispute resolution procedures.

Delta Levee Risk Assessment and Risk Management Strategy. The goals of this strategy are to quantify the risks to Delta levees, evaluate the consequences, and develop an appropriate risk management strategy by the end of Stage 1.

Suisun Marsh Levee System Plan. The CALFED Program will evaluate whether to include the Suisun Marsh levee system in the Levee Integrity Plan, and, if included, what level of protection is appropriate. This plan will evaluate the appropriate level of protection for Suisun Marsh levees, evaluate the best method of protection, and implement the method during Stage 1. This plan may protect part of the levee system by rehabilitating and maintaining some levees to protect managed wetlands and develop new tidal wetlands. Implementation will incorporate ERP and MSCS actions, consistent with Service-approved recovery plans.

Proposed Levee System Integrity Program Stage 1 Actions

The CALFED Agencies will evaluate the following Levee System Integrity Program actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the Levee System Integrity Program.

- Initiate the Levee Program Coordination Group. Develop and implement an outreach, coordination, and partnering program with local landowners including individuals, cities, counties, reclamation districts, resource conservation districts, water authorities, irrigation

districts, farm bureaus, other interest groups, and the general public to assure participation in planning, design, implementation, and management of levee projects (yr 1).

- Obtain short-term Federal and State funding authority as a bridge between the existing Delta Flood Protection Authority (AB 360) and long-term levee funding (yr 1-5).
- Obtain long-term Federal and State funding (yr 1-7).
- Conduct project level environmental documentation and obtain appropriate permits for each action/group of actions (yr 1-7).
- Implement demonstration projects for levee designs, construction techniques, sources of material, reuse of dredge material, and maintenance techniques that maximize ecosystem benefits while still protecting lands behind levees. Give priority to those levee projects which include both short (i.e., construction) and long-term (i.e., maintenance and design) ecosystem benefits, and provide increased information (yr 1-7).
- Adaptively coordinate Delta levee improvements with ecosystem improvements by incorporating successful techniques for restoring, enhancing, or protecting ecosystem values developed by levee habitat demonstration projects or ecosystem restoration projects into levee projects. Continue to develop techniques as major levee projects are implemented (yr 1-7).
- Fund levee improvements up to PL 84-99 criteria in Stage 1; e.g., proportionally distribute available funds to entities making application for cost sharing of Delta levee improvements (yr 1-7).
- Further improve levees which have significant Statewide benefits in Stage 1; e.g., State-wide benefits to water quality and highways (yr 1-7).
- Coordinate Delta levee improvements with Stage 1 water conveyance, water quality improvements (yr 1-7).
- Enhance existing emergency response plans; e.g., establish a revolving fund, refine command and control protocol, stockpile flood fighting supplies, establish standardized contacts for flood fighting and recovery operations, and outline environmental considerations during emergencies (yr 1-7).
- Implement current Best Management Practices (BMPs) to correct subsidence effects on levees. Assist CALFED Program's Science Program activities to quantify the effect and extent of inner-island subsidence and its linkages to all CALFED Program objectives (yr 1-7).
- Develop BMPs for the reuse of dredge materials (yr 1).
- Institute a program for using Bay and Delta dredge material to repair Delta levees and restore Delta habitat (yr 1-7).
- Complete total risk assessment for Delta levees and develop and begin implementation of risk assessment options as appropriate to mitigate potential consequences (yr 1-7).

- Complete the evaluation of the best method for addressing the Suisun Marsh levee system (yr 1-2).

Water Quality Program

The CALFED Program's WQP will strive to create water quality conditions that fully support a healthy and diverse ecosystem and the multiplicity of human uses of water. The geographic scope of the WQP encompasses five regions: the legal Delta; the Bay Region which includes Suisun Bay and Marsh, San Pablo Bay, and the San Francisco Bay watershed; the Sacramento River Region, bounded by the ridge tops of the Sacramento River watershed or hydrologic region; the San Joaquin River Region which includes both the San Joaquin River and Tulare Lake hydrologic basins; and, SWP and CVP service areas outside the Central Valley.

The CALFED Program's Water Quality Technical Group has identified the following water quality parameters of concern to beneficial uses: mercury, selenium, trace metals (copper, cadmium, and zinc), pesticides (carbofuran, chlorodane, chloropyrifos, DDT, diazinon, PCBs, and toxaphene), drinking water disinfection by-product precursors (bromide and total organic carbon), dissolved oxygen and oxygen reducing substances, ammonia, salinity (total dissolved solids), temperature, turbidity and sedimentation, pathogens, nutrients (nitrogen and phosphorus), pH (alkalinity), chloride, boron, sodium absorption ratio, and toxicity of unknown origin. These parameters provide the focal points for developing and implementing the CALFED Program's water quality actions. The July 2000 Water Quality Program Plan, a technical appendix to the CALFED Program's Final PEIS/PEIR, provides a full description of the WQP. Individual projects pursued under the WQP will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA.

Water Quality Program Plan

The Water Quality Program, largely through its agency-stakeholder Water Quality Technical Group, has developed programmatic actions to address water quality parameters of concern and beneficial use impairments. Water quality impairments or problems and associated programmatic actions to treat these problems are described in the WQP Plan. The WQP Plan is organized by the following sections: low dissolved oxygen and oxygen depleting substances, drinking water, mercury, pesticides, organochlorine pesticides, salinity, selenium, trace metals, turbidity and sedimentation, toxicity of unknown origin, and a section on implementation strategy. The environmental water quality components, including proposed actions, were transferred to and are now administered under the ERP. However, to maintain consistency between the Draft PEIS and Final PEIS, CALFED Agencies have left the environmental components in the WQP Plan.

Proposed Water Quality Program Stage 1 Actions

The CALFED Agencies will evaluate the following water quality actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the WQP Plan.

General Water Quality Actions

- Prepare project level environmental documentation and permitting as needed (yr 1-7).
- Coordinate with other CALFED Program elements to ensure that in-Delta actions maximize potential for Delta water quality improvements (yr 1-7).
- Continue to clarify use of and fine-tune water quality performance targets and goals (yr 1-7).

Environmental Water Quality Action:

Conduct the following mercury evaluation and abatement work:

Cache Creek:

- Risk appraisal and advisory for human health impacts of mercury (yr 1-5).
- Support development and implementation of Total Maximum Daily Load (TMDL) for mercury (yr 1-7).
- Determine bioaccumulation effects in creeks and the Delta (yr 1-4).
- Source, transport, inventory, mapping and speciation of mercury (yr 1-7).
- Information Management/Public Outreach (yr 5-7).
- Participate in Stage 1 remediation (drainage control) of mercury mines as appropriate (yr 3-5).
- Investigate sources of high levels of bioavailable mercury (yr 4-7).

Sacramento River:

- Investigate sources of high levels of bioavailable mercury; inventory, map, and refine other models (yr 3-7).
- Participate in remedial activities (yr 7).

Delta:

- Research methylization (part of bioaccumulation) process in Delta (yr 1-2).
- Determine sediment mercury concentration in areas that would be dredged during levee maintenance or conveyance work (yr 3-7).
- Determine potential impact of ecosystem restoration work on methyl mercury levels in lower and higher trophic level organisms (yr 3-5).

Conduct the following pesticide work:

- Develop diazinon and chlorpyrifos hazard assessment criteria with the CDFG and the Department of Pesticide Regulations (yr 1).

- Support development and implementation of a TMDL for diazinon (yr 1-7).
- Develop BMPs for dormant spray and household uses (yr 1-3).
- Study the ecological significance of pesticide discharges (yr-1-3).
- Support implementation of BMPs (yr 2-7).
- Monitor to determine effectiveness (yr 4-7).

Conduct the following trace metals work:

- Determine spatial and temporal extent of metal pollution (yr 3-7).
- Determine ecological significance and extent of copper contamination (yr 1-3).
- Review impacts of other metals such as cadmium, zinc, and chromium (yr 1).
- Participate in Brake Pad Partnership to reduce introduction of copper (yr 1-7).
- Partner with municipalities on evaluation and implementation of stormwater control facilities (yr 2-5).
- Participate in remediation of mine sites as part of local watershed restoration and Delta restoration (yr 2-7).

Conduct the following selenium work:

- Conduct selenium research to fill data gaps in order to refine regulatory goals of source control actions; determine bioavailability of selenium under several scenarios (yr 1-5).
- Evaluate and, if appropriate, implement real-time management of selenium discharges (yr 1-7).
- Expand and implement source control, treatment, and reuse programs (yr 1-7).
- Coordinate with other programs (yr 1-7); e.g., recommendations of San Joaquin Valley Drainage Implementation Program, and CVPIA for retirement of lands with drainage problems that are not subject to correction in other ways.

Conduct the following sediment reduction work/organochlorine pesticides:

- Participate in implementation of the United States Department of Agriculture (USDA) sediment reduction program (yr 1-7).
- Promote sediment reduction in construction areas and urban stormwater, and other specific sites (yr 1-7).
- Implement stream restoration and revegetation work (yr 4-7).
- Quantify and determine ecological impacts of sediments in target watersheds, implement corrective actions (yr 4-7).
- Coordinate with ERP on sediment needs (yr 1-3).

Conduct the following work addressing dissolved oxygen (DO) and oxygen depleting substances (including nutrients):

- Complete studies of causes for DO sag in San Joaquin River near Stockton (yr 1-2).
- Define and implement corrective measures for DO sag (yr 1-7).

- Encourage regulatory activity to reduce nutrients discharged by unpermitted dischargers (yr 1-7).
- Develop inter-substrate DO testing in conjunction with the ERP (yr 2-4).
- Study nutrient effects on beneficial uses (yr 4-7).
- Develop, implement, and support measures to reduce pollutant (oxygen depleting substances, nutrients, and ammonia) discharges from concentrated animal feeding operations (yr 1-7).
- Support finalizing investigation of methods to reduce constituents that cause low DO for inclusion in TMDL recommendation by the Central Valley Regional Water Quality Control Board (yr 2).
- Support finalization of Basin Plan Amendment and TMDL for constituents that cause low DO in the San Joaquin River (yr 2).
- Support implementation of appropriate source and other controls as recommended in the TMDL (yr 3).
- Participate in identifying unknown toxicity and addressing as appropriate (yr 1-7).

Drinking Water Quality Actions

Actions specific to drinking water improvements:

- Work with Bay Area water suppliers as they develop a Bay Area Blending/ Exchange Project (yr 1-7).
- Address drainage problems in the San Joaquin Valley to improve downstream water quality (yr 1-7).
- Implement source controls in the Delta and its tributaries (yr 1-7).
- Support ongoing efforts of the Delta Drinking Water Quality Council (yr 1-7).
- Invest in treatment technology demonstrations (yr 1-7).
- Control runoff into the California Aqueduct and other similar conveyances (yr 1-7+).
- Address water quality problems at the North Bay Aqueduct (yr 1-7).
- Conduct comprehensive evaluations, pilot programs, and full scale actions to reduce Total Organic Carbon (TOC) contribution through control of algae, aquatic weeds, agricultural runoff, and watershed improvements (yr 1-7).
- Improve DO concentrations in the San Joaquin River near Stockton (yr 1-3).
- Study recirculation of export water to reduce salinity and improve DO in the San Joaquin River. If feasible, and consistent with ERP goals and objectives, implement a pilot program (yr 1-4).

Ecosystem Restoration Program

The Ecosystem Restoration Program (ERP) will improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta estuary and its watershed to support sustainable populations of diverse plant and animal species. All CALFED Program elements will contribute in varying degrees to this goal, with the ERP being the principal CALFED Program element designed to restore the ecological health of the Bay-Delta system. The ERP includes actions throughout the Bay-Delta watershed, focusing on the restoration of ecological processes and important habitats. The CALFED Program proposes to improve ecosystem quality for the Bay-Delta system in order to reduce conflicts among beneficial uses of California's water. Individual projects pursued under the ERP will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA.

The primary geographic focus area of the ERP is the Sacramento-San Joaquin Delta, Suisun and San Pablo Bay, the Sacramento River below Shasta Dam, the San Joaquin River below the confluence with the Merced River, and their major tributary watersheds directly connected to the Bay-Delta system below major dams and reservoirs. This primary geographic focus area is divided into 14 ecological management zones (discussed in Ecosystem Restoration Program Plan Volume II). The secondary geographic focus area is the upper watersheds surrounding the primary focus area and Central and South San Francisco Bay and their local watersheds.

Success of the CALFED Program hinges upon the full and successful funding and implementation of the ERP, MSCS, other existing and tiered biological opinions, as well as other environmental commitments. Although it is anticipated that some ERP actions will be refined or altered, based upon new information and adaptive management, the successful implementation of nearly all actions is necessary to achieve the species recovery goals identified in the ERP. The ERP is not designed as mitigation for projects to improve water supply reliability or to bolster the integrity of Delta levees, although it is expected that the environmental benefits associated with implementation of the ERP will facilitate the review of such projects. Improving ecological processes and increasing the amount and quality of habitat are co-equal with other CALFED Program goals related to water supply reliability, water quality, and levee system integrity.

The ERP is comprised of a Strategic Plan and a two-volume restoration plan: Volume I which describes the ecosystem elements or attributes (ecological processes, habitats, species and species groups, and anthropogenic stressors) the program addresses; and, Volume II which presents the ecological management zones and proposed programmatic actions. The ERP would require individual section 7 consultations for actions which may affect listed species.

<u>Ecosystem Restoration Program Strategic Plan and Goals</u>

The ERP Strategic Plan contains the following goals and objectives:

- Goal 1: Achieve recovery of at-risk native species dependent on the Delta and Suisun Bay as the first step toward establishing large, self-sustaining populations of these species; support similar recovery of at-risk native species in San Francisco Bay and the watershed above the estuary; and minimize the need for future endangered species listings by reversing downward population trends of native species that are not listed.
- Goal 2: Rehabilitate natural processes in the Bay-Delta estuary and its watershed to fully support, with minimal ongoing human intervention, natural aquatic and associated terrestrial biotic communities and habitats, in ways that favor native members of those communities.
- Goal 3: Maintain and/or enhance populations of selected species for sustainable commercial and recreational harvest, consistent with the other ERP goals.
- Goal 4: Protect and/or restore functional habitat types in the Bay-Delta estuary and its watershed for ecological and public values such as supporting species and biotic communities, ecological processes, recreation, scientific research, and aesthetics.
- Goal 5: Prevent the establishment of additional non-native invasive species and reduce the negative ecological and economic impacts of established non-native species in the Bay-Delta estuary and its watershed.
- Goal 6: Improve and/or maintain water and sediment quality conditions that fully support healthy and diverse aquatic ecosystems in the Bay-Delta estuary and watershed; and eliminate, to the extent possible, toxic impacts to aquatic organisms, wildlife, and people.

There are several objectives under each goal. ERP goals and objectives are integrated with those of the CALFED Program's MSCS, WQP, and Nonnative Invasive Species Strategic Plan.

The ERP Strategic Plan also presents and describes:

- An ecosystem based management approach for restoring and managing the Bay-Delta ecosystem.
- An adaptive management process that is sufficiently flexible and iterative to respond to changing Bay-Delta conditions and to incorporate new information about ecosystem structure and function.
- The value and application of conceptual models in developing restoration actions and defining information needs, with examples of their development and use.
- Institutional and administrative considerations necessary to implement adaptive management, to ensure scientific credibility of the restoration program and to engage the public in the restoration program.

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- Decision rules and criteria to help guide the selection and prioritization of restoration actions.
- Opportunities and constraints to be considered in developing a restoration program.

Ecosystem Restoration Program Plan

The Ecosystem Restoration Program Plan (ERPP) is composed of two volumes. Volume I presents the elements or components of the ERP. These "ecosystem elements" are organized into four categories: ecological processes (e.g., central valley stream flows, Bay-Delta hydrodynamics, bay-delta aquatic foodweb); habitats (e.g., tidal perennial aquatic, saline emergent wetland, riparian and riverine aquatic); species and species groups (species designated for recovery, species designated for contribute to recovery, species assemblages designated for enhance and/or conserve biotic communities, harvested species to be maintained and/or enhanced); and, stressors (e.g., water diversions, nonnative invasive species, contaminants, gravel mining). Consult ERPP Volume I for the complete list and description of ERP ecosystem elements (total of 106 elements).

ERPP Volume II identifies over 600 programmatic actions to be implemented throughout the Bay-Delta estuary and its watershed over the 30-year period of the CALFED Program. Volume II also gives targets for the ecosystem elements (e.g., acres of tidal fresh emergent wetland to be restored). Volume II is organized by Ecological Management Zones. The primary ERP geographic focus area is divided into 14 Ecological Management Zones: Sacramento-San Joaquin Delta, Suisun Marsh/North San Francisco Bay, Sacramento River, North Sacramento Valley, Cottonwood Creek, Colusa Basin, Butte Basin, Feather River/Sutter Basin, American River Basin, Yolo Basin, Eastside Delta Tributaries, San Joaquin River, East San Joaquin, and West San Joaquin. Each zone is further divided into Ecological Management Units. Under each Ecological Management Zone are the ecosystem elements and associated proposed programmatic actions and restoration targets that the ERP will address in that zone. There is also a section in Volume II that gives ERP targets, MSCS species goal prescriptions, and MSCS conservation measures for species and species groups ecosystem elements.

Proposed Ecosystem Restoration Program Stage 1 Actions

CALFED Agencies will evaluate the following ERP actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the ERP:

- Develop and implement an outreach, coordination, and partnering program with local landowners and individuals, cities, counties, reclamation districts, the Delta Protection Commission, resource conservation districts, water authorities, irrigation districts, farm bureaus, other interest groups, and the general public to assure participation in planning design, implementation, and management of ecosystem restoration projects (yr 1-7).
- Conduct project level environmental documentation and permitting as needed for each bundle of Stage 1 actions (yr 1-7).
- Fully coordinate with other ongoing activities which address ecosystem restoration in the Bay-Delta system; e.g., CVPIA, Four Pumps Agreement, Non-native Invasive Species Task Force (yr 1-7).
- Implement habitat restoration in the Delta, Suisun Bay and Marsh, and Yolo Bypass to improve ecological function and facilitate recovery of endangered species consistent with the goals of the ERP Strategic Plan and MSCS. Habitat restoration efforts in Stage 1 will: restore 2,000 acres of tidal perennial aquatic habitat; restore 200 acres of deep open water nontidal perennial aquatic habitat; restore 300 acres of shallow open water nontidal perennial aquatic habitat; enhance and restore 50 miles of Delta slough habitat; enhance and restore 50 to 200 acres of midchannel islands; restore 8,000 to 12,000 acres of fresh emergent (tidal) wetlands; restore 4,000 acres of fresh emergent (non-tidal) wetlands; restore 25 miles of riparian and riverine aquatic habitat; restore 1,000 to 2,000 acres of perennial grassland; and establish 8,000 to 12,000 acres of wildlife-friendly agricultural habitat. These actions represent approximately one-fourth of the acreage identified in the ERP to be restored during the 30-year implementation period (yr 1-7).
- Implement large-scale restoration projects on select streams and rivers (e.g., Clear Creek, Deer Creek, and the Tuolumne River) that would include implementation of all long-term restoration measures in coordination with the watershed management common program and monitoring of subsequent ecosystem responses to learn information necessary for making decisions about implementing similar restorations in later stages (yr 1-7).
- Implement an EWA that acquires water for ecosystem and species recovery needs, substantially through voluntary purchases in the water transfer market in its first few years and developing additional assets over time (yr 1-7).

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- Pursue full implementation of ERP upstream flow targets, over and above EWA assets and regulatory actions, through voluntary purchases of at least 100,000 acre-feet of water by the end of Stage 1. Evaluate how the ERP water acquisitions and EWA water acquisitions will be integrated most effectively (yr 1-7).
- Complete targeted research and scientific evaluations needed to resolve the high priority issues and the uncertainties identified in the ERP Strategic Plan (e.g., instream flow, non-native organisms, and Bay-Delta food web dynamics) to provide direction for implementing the adaptive management process and information necessary for making critical decisions in later stages (yr 1-7).
- Establish partnerships with universities for focused research (yr 1-7).
- Acquire floodplain easements, consistent with ecosystem and flood control needs along the Sacramento and San Joaquin Rivers (yr 4-7).
- Continue high priority actions that reduce direct mortality to fishes (yr 1-7):
    - Screen existing unscreened or poorly screened diversions in the Delta, on the Sacramento River, San Joaquin River, and tributary streams based on a systematic priority approach.
    - Remove select physical barriers to fish passage.
- Continue gravel management, e.g., isolate gravel pits on San Joaquin River tributaries and relocate gravel operations on Sacramento River tributaries. Most gravel work would be implemented in subsequent stages with designs and plans for ecosystem reclamation of gravel mining sites (yr 1-7).
- Develop and begin implementing a CALFED Program comprehensive non-native (exotic) invasive species prevention, control, and eradication plan including the following (yr 1-7):
    - Implement invasive plant management program in Cache Creek.
    - Develop ballast water management program.
    - Develop early-response invasive organism control programs.
    - Evaluate CALFED Program implementation actions and how those actions may benefit non-native species to the detriment of native species or the Bay-Delta ecosystem.
- Provide incremental improvements in ecosystem values throughout the Bay-Delta system in addition to habitat corridors described above, e.g., pursue actions that are opportunity-based (willing sellers, funding, permitting), provide incremental improvements on private land through incentives, and develop partnerships with farmers on "environmentally friendly" agricultural practices (yr 1-7).
- Incorporate ecosystem improvements with levee associated subsidence reversal plans (yr 1-7).
- Evaluate the feasibility of harvest management to protect weaker fish stocks (yr 1-7).
- Implement projects on selected streams to provide additional upstream fishery habitat by removing or modifying barriers (yr 1-7).

- Assist in the preparation of detailed, ecosystem-based restoration and recovery plans for any priority species identified in the ERP Strategic Plan and the MSCS for which up-to-date plans are not available. Begin implementing appropriate additional restoration actions identified in these plans (yr 1-7).
- Identify and advance specific regional ERP goals (yr 1-7).

Additional draft ERP Stage 1 actions are presented by Ecological Management Zone in Appendix D of the ERP Strategic Plan.

Water Use Efficiency Program

The Water Use Efficiency Program (WUE) relies on a combination of technical assistance, incentives, and directed studies for the four WUE program elements: Agricultural Water Conservation, Urban Water Conservation, Water Recycling, and Managed Wetlands.

Technical assistance programs and directed studies will begin for all four elements. Incentive programs will be designed to award CALFED Program grant funding for projects that demonstrate potential to provide the CALFED Program water supply reliability, water quality, or ecosystem restoration benefits.

The WUE Program includes water conservation and water recycling actions to facilitate efficient use of water at the regional and local level. Individual projects pursued under the WUE will fully evaluate all alternatives during tiered environmental review and will fully analyze and address effects under section 7 or section 10 of the ESA. The programmatic water use efficiency actions include the following:

<u>Water Conservation Related Actions</u>

- Work with the California Urban Water Conservation Council and the Agricultural Water Management Council (AWMC) to identify appropriate urban and agricultural water conservation measures, set appropriate levels of effort, and, in the case of the urban effort, identify a proper entity and process to certify or endorse water suppliers that are implementing cost-effective feasible measures.
- Expand State and Federal programs to provide sharply increased levels of planning, technical, and financing assistance and develop new ways of providing assistance in the most effective manner.
- Assist urban water suppliers comply with the Urban Water Management Planning Act.

- Assist water suppliers and water users to identify and implement water management measures that can yield multiple benefits, including improved water quality and reduced ecosystem impacts.
- Identify and implement practices to improve water management on managed wetlands.
- Gather better information on water use, identify opportunities to improve water use efficiency, and measure the effectiveness of conservation practices.
- Identify, in region-specific Strategic Plans for Agricultural Areas, quantifiable objectives to assure improvements in water management.

Water Recycling Actions:

- Assist local and regional agencies comply with the water recycling provisions in the Urban Water Management Planning Act.
- Expand State and Federal recycling programs in order to provide increased levels of planning, technical, and financing assistance (both loans and grants), and develop new ways of providing assistance in the most effective manner.
- Provide regional planning assistance that can increase opportunities for use of recycled water.

Proposed Water Use Efficiency Stage 1 Actions

CALFED Agencies will evaluate the following WUE actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the WUE Program.

- Expand existing State and Federal agricultural Water Conservation Programs to support on farm and district efforts. Expand State and Federal programs to provide technical and planning assistance to local agencies and districts in support of local and regional conservation and recycling programs (yr 1-7).
- Expand existing State and Federal conservation programs to support urban water purveyor efforts. Expand State and Federal programs to provide technical and planning assistance in support of conservation and recycling programs (yr 1-7).
- Utilize AB 3616 of the Agricultural Water Management Council to evaluate and endorse Agricultural Water Management Plans to implement cost-effective water management practices by agricultural districts. Identify and secure ongoing funding sources for

Agricultural Water Management Council and its members seeking to actively participate in the development, review, and implementation of these plans (yr 1-7).

- Develop Urban Water Management Plan Certification Process - Select an agency to act as certifying entity, obtain legislative authority, carry out public process to prepare regulations, and implement program (yr 1-3).
- Implement Urban BMPs Certification Process. Implement a process for certification of water suppliers' compliance with terms of the Urban Memorandum of Understanding (MOU) with respect to BMPs analysis and implementation for urban water conservation. Provide funding support for the California Urban Water Conservation Council (CUWCC) to carry out this function (yr 1-7).
- Prepare a program implementation plan, including a proposed organizational structure consistent with the overall CALFED Program governance structure, for a competitive grant/loan incentive program for WUE (yr 1). This will include:
    - Incentives in the agricultural sector that will consider several factors, including: (i) potential for reducing irrecoverable water losses; (ii) potential for attaining environmental and/or water quality benefits from WUE measures which result in reduced diversions; (iii) regional variation in water management options and opportunities; (iv) availability and cost of alternative water supplies; and (v) whether the recipient area experiences recurrent water shortages due to regulatory or hydrological restrictions. Many of these factors are included in the Quantifiable Objectives for Agricultural Water Use Efficiency, and as such, the Quantifiable Objectives will be an important component of the agricultural incentive criteria.
    - Incentives in the urban sector will assist in identifying and implementing urban water conservation measures that are supplemental to BMPs in the Urban MOU process and are cost effective from a Statewide perspective.
    - Incentives for water recycling in the urban and agricultural areas.
    - Annual reporting and evaluation mechanisms to gauge effectiveness of the program.
- Finalize and implement the methodology for Refuge Water Management which was described in the June 1998 "Interagency Coordinated Program for Wetland Water Use Plan, Central Valley, California" (yr 1-3).
- Research effort to establish appropriate reference conditions for evaluating program progress, and to identify improved methods for WUE (yr 1-7).
- Assess the need for additional water rights protections. Evaluate the need for additional State regulations or legislation providing protection for water right holders who have implemented WUE measures and subsequently transferred water to other beneficial uses (yr 1-4).

- Water Management. Develop State legislation that requires appropriate measurement of water use for all water users in California (yr 1-3).
- Create a Public Advisory Committee to advise State and Federal agencies on structure and implementation of assistance programs, and to coordinate State, Federal, regional and local efforts for maximum effectiveness of program expenditures (yr 1).

Water Transfer Program

The CALFED Program's Water Transfer Program (WTP) will encourage the development of a more effective water transfer market that facilitates water transfers and streamlines the approval process while protecting water rights, environmental conditions, and local economic interests. CALFED Agencies have legal and regulatory responsibility for review and approval of most water transfers and also have jurisdiction over many of the storage and conveyance facilities required to make water transfers work. These agencies are in a position to improve or facilitate the operations of the water market by adopting policies and implementing programs that will allow transfers to be completed efficiently while protecting the environment. The Strategic Plan for Implementation provides direction and prioritization for implementation of the CALFED Program's Water Transfer Program, and includes the following actions:

<u>Interactive California Water Market Information Web Site</u>

- Develop the On Tap on-line water market information source for California water transfers.

<u>Environmental, Socio-economic, and Water Resource Protection</u>

- Recommend establishment of a California Water Transfers Information Clearinghouse to ensure that decisions regarding proposed water transfers can be made with all parties in possession of complete and accurate information and to facilitate assessment of potential third party impacts.
- Require additional water transfer analysis regarding direct and indirect impacts. The DWR, Reclamation, and the State Water Resources Control Board (SWRCB) will require transfer proponents to provide analysis of the direct and indirect impacts of a proposed transfer, in addition to CEQA, ESA compliance or other environmental requirements.
- Develop improved tracking protocols to ensure that water transferred to an instream flow can be tracked and then delivered to the intended destination.

- Work with stakeholders and the State Legislature to assist local agencies in development of groundwater management programs to protect groundwater basins in water transfer source areas.

Technical, Operational, and Administrative Rules

- Work to streamline the current water transfer approval processes through development of new tools, clarification of existing policies, refinement of processes and addition of staff and resources.
- Work with stakeholder representatives to clarify and define what water is deemed transferrable under what conditions.
- Work with stakeholder representatives to resolve conflicts over carriage water criteria.
- Work with stakeholder representatives to develop criteria that protect other legal users of water from injury as a result of refill of a reservoir after the transfer of stored water.

Wheeling and Access to State/Federal Facilities

- Improve forecasting tools and more widely disclose potential pumping and conveyance capacity in project facilities, including limiting factors and inherent risks.
- Work with stakeholder representatives to consider modification of policies and procedures for transporting non-project water through existing project water conveyance facilities.
- Work with stakeholder representatives to develop cost criteria associated with transporting transferred water through State or Federal conveyance facilities.

Proposed Water Transfer Program Stage 1 Actions

CALFED Agencies will evaluate the following actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the Water Transfer Program.

- Develop an Interactive Water Transfer Information Web-site. CALFED Agencies will develop, implement, and maintain an interactive, publicly available web-site called On TAP (by the end of year 2000) (yr 1).
- Establish the California Water Transfers Information Clearinghouse to operate and maintain the On Tap web-site, collect and disseminate data and information relating to water transfers and potential transfer impacts, and perform research using historic data to understand water transfer impacts (by year 2001) (yr 1).

- Coordinate with CALFED Agencies to require water transfer applicants to provide additional impact assessment information (yr 1-4).
- Identify, arrange, fund, and carry out a specific number of targeted water transfers for in-stream environmental purposes as part of the ERP, with a goal of using these transfers to evaluate the effectiveness of and make any necessary improvements to the California Water Code Section 1707 procedures and tracking protocols (yr 1-3).
- Establish a groundwater assistance program to fund studies to gather groundwater data and to enable local entities to develop and implement local groundwater management/monitoring programs (yr 1-2).
- Develop a streamlined water transfer approval process including "pre-certification" of certain classes of transfers and expedited environmental review procedures (yr 1-6).
- Work with stakeholder representatives to clarify and define what water is deemed transferrable under what conditions (yr 1-3).
- Continue to work with stakeholder representatives to resolve conflicts over carriage water criteria (yr 1-3).
- Establish a refill criteria policy for reservoir storage based water transfers (yr 1).
- Begin forecast and disclosure processes of potential conveyance capacity in existing export facilities (Reclamation and DWR). This would be an on-going activity, occurring in conjunction with hydrologic forecasts (yr 1-7).
- Work with stakeholders to develop an agreed upon set of criteria and procedures governing the determination of transport system availability and costs, including the procedures to determine the fair reimbursement to the water conveyance facility operator (yr 1-3).

Watershed Program

The Watershed Program will use a comprehensive, integrated, basin-wide approach with a goal to improve conditions in the Bay-Delta system. This Watershed Program will emphasize local participation and provide financial and technical assistance for local watershed stewardship, and promote coordination and collaboration among watershed efforts.

The geographic scope of the Watershed Program encompasses the entire scope of the CALFED Program. The Watershed Program will support activities that provide benefits to the Delta, Suisun Bay, and Suisun Marsh.

The Watershed Program covers a broad geographic range and currently lacks project-specific measures for evaluation. Individual projects pursued under the Watershed Program will fully evaluate all alternatives during tiered environmental review and will fully analyze and address

effects under section 7 or section 10 of the ESA. CALFED will ensure that appropriate measures to conserve special status species are included in all program actions.

There are five Watershed Program elements: coordination and assistance; adaptive management and monitoring; education and outreach; integration with other CALFED Program elements; and watershed processes and relationships. These elements, associated proposed programmatic actions, and an implementation strategy are described in the Watershed Program Plan.

The primary objectives of the Watershed Program are:

- Facilitate and improve coordination, collaboration, and assistance among government agencies, other organizations, and local watershed groups.
- Develop watershed monitoring and assessment protocols.
- Support education and outreach.
- Integrate the Watershed Program with other CALFED Program elements.
- Define the relationship between watershed processes and the goals and objectives of the CALFED Program.
- Implement a strategy that will ensure support and long term sustainability of local watershed activities.

Watershed activities will be supported that:

- are community based
- are collaborative and are consistent with the CALFED Program
- address multiple watershed issues
- are coordinated with and supported at multiple levels
- provide ongoing implementation
- include monitoring protocols
- increase learning and awareness.

Proposed Watershed Program Stage 1 Actions

The CALFED Program will evaluate the following Watershed Program actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the Watershed Program Plan.

- Fund and implement community based watershed restoration, maintenance, conservation, and monitoring activities that support the goals and objectives of the CALFED Program (yr 1-7).
- Assist local watershed groups and government agencies to address common issues, including roles and responsibilities, funding support, technical assistance, information exchange, and to ensure effective communication and implementation among government agencies and stakeholder groups (yr 1-7).
- Implement a funding process and provide watershed stewardship funds to build the capacity of locally controlled watershed groups that ensure participation of local landowner groups (yr 1-7).
- Improve the use and usefulness of existing or future watershed information management functions to provide data and other information to people involved in watershed management (yr 3-7).
- Ensure the completion of project level environmental documentation and permitting; assist with documentation and permitting processes as appropriate (yr 1-7).
- Evaluate the benefits that accrue from watershed plans and projects designed to achieve CALFED Program goals and objectives (yr 3-7).
- Establish, fund, and maintain watershed restoration and maintenance assistance to aid local watershed groups and private landowners in project concept, design, and implementation (yr 1-7).
- Collaborate with other CALFED Program and non-CALFED Program elements on watershed related activities (yr 1-7).
- Provide appropriate information and assistance to stakeholders and the State Legislature to develop a Statewide umbrella Watershed Management Act (yr 1).

Water Management Strategy

The Water Management Strategy (WMS) describes a framework to coordinate and integrate the water management tools in the program, evaluate the success of implementation efforts, and select additional tools needed to achieve the CALFED Program's water reliability objectives. The CALFED Program has identified three primary goals for the WMS: increase the utility of available water supplies (making water suitable for more uses and reuses); improve access to existing or new water supplies in an economically efficient manner, for environmental, urban and agricultural beneficial uses; and, improve flexibility of managing water supply and demand in order to reduce conflicts between beneficial uses and decrease system vulnerability.

The tools that will be used to achieve the goals and objectives of the WMS include: the WUE Program (agricultural, urban, and wetland water conservation and water recycling); the Water

Transfer Program; Conveyance, including South Delta Improvements; Storage; and, operational strategies, such as real-time diversion management and an EWA. In addition to these primary tools, the WMS will rely on additional CALFED Program tools to provide additional benefits. These include the Watershed Program, the Water Quality Program, and real-time monitoring through the Science Program.

Storage

The CALFED Program has initiated the Integrated Storage Investigation (ISI) to provide a comprehensive assessment of alternative surface and groundwater storage options and their utility to overall water management.

Decisions to implement new or expanded surface and groundwater storage will be predicated upon completing site-specific feasibility studies and complying with all environmental review and permitting requirements. Individual storage projects pursued under the WMS will fully evaluate project-level alternatives that are consistent with the decision documents in conformance with the legal requirements of section 404, as implemented under the Memorandum of Understanding for section 404 of the Clean Water Act for the CALFED Program. The level of analysis required for specific storage projects will depend upon the programs and related commitments of the CALFED Program, including those related to water use efficiency, water transfers, and the ERP, being implemented. Direct and indirect effects, as appropriate, will be addressed under section 7 or section 10 of the ESA.

Site-specific studies of storage opportunities will be coordinated under the ISI. Specifically, the ISI will evaluate surface storage, groundwater storage, power facility re-operation, and removal of barriers to fish passage and, where appropriate, the potential for conjunctive operation of these different types of storage. These investigations will contribute to compliance with the requirements, within the Clean Water Act Section 404 Guidelines, and pursuant to the EPA and Corps Memorandum of Understanding.

The range of total new storage evaluated in Phase II was from zero up to about six Million acre-feet (MAF). Maximum Sacramento River off-stream or enlarged on-stream surface storage potential is estimated to be about three MAF of storage, while south of Delta off-aqueduct surface storage potential is estimated to be about two MAF of storage. Other types of surface storage considered in Phase II include San Joaquin River tributary storage and in-Delta storage. The CALFED Program will evaluate the feasibility of expanding two existing reservoirs and constructing a new off-stream reservoir with a total capacity of 950 thousand-acre-feet (TAF); and a major expansion of groundwater storage for an additional 500 TAF to one MAF. In

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addition, the CALFED Program will study two potential reservoir locations through partnerships with local agencies.

The CALFED Program will continue to evaluate surface and groundwater storage opportunities; initiate permitting, NEPA and CEQA documentation; and proceed with construction, only if all conditions are satisfied. In addition, the CALFED Program will continue to refine and periodically update the WMS. ISI studies will evaluate the utility of specific storage projects in providing water quality, water supply reliability, and ecosystem benefits. This information, together with information gained from implementation of other CALFED Program elements and updated information on California's changing water management needs, will be considered in an Evaluation Framework. This Evaluation Framework will include: 1) a comprehensive hierarchy of objectives for the CALFED Program; 2) well-defined measures of performance associated with the achievement of objectives; and 3) a basis for comparison of alternative long-term water management strategies. The Evaluation Framework will provide a structure for periodically updating the WMS and determining appropriate levels of the future investment in various water management tools.

Proposed Stage 1 Storage Actions

The CALFED Program will evaluate the following Storage actions proposed for implementation during Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the Storage Program. It is expected that each will require project-specific consultation under section 7 or a permit under section 10 of the ESA.

Groundwater Banking and Conjunctive Use The goal is to develop locally managed and controlled groundwater and conjunctive use projects with a total of 500 TAF to one MAF of additional storage. This effort includes developing partnerships with local agencies and landowners in both the north-of-Delta and south-of-Delta areas, and includes the potential construction of several south-of-Delta projects. Additional south-of-Delta and north-of-Delta projects, if feasible, could be constructed in later stages.

- Finalize agreements with new local project proponents for joint planning and development (yr 1).
- Begin feasibility studies (yr 1).
- Report on the performance of feasibility studies, implemented projects, and potential benefits and beneficiaries (yr 3).
- Implement early stages of the most promising projects (yr 1-5).

- Pursue implementation of additional projects (yr 1-7).
- Support legislation that supports groundwater management by local agencies at the sub-basin level.

Surface Storage CALFED Agencies identified a list of twelve potential surface storage projects that are in varying stages of the environmental review or feasibility process. Actions taken in Stage 1 will focus on completing the necessary studies (technical work and environmental reviews) needed before implementing or proceeding with the six surface storage projects:

- In-Delta storage project (approximately 250 TAF). CALFED will evaluate leasing or purchasing the Delta Wetlands project, and will evaluate initiating a new project, in the event that Delta Wetlands proves cost prohibitive or infeasible (Planning: yr 1-2, Construction: yr 3-7).
- Evaluate expanding CVP storage in Shasta Lake by approximately 300 TAF by raising the Shasta Dam by three to six feet (Planning: yr 1-4, Construction yr 6-7).
- Evaluate expanding Los Vaqueros Reservoir by up to 400 TAF with local partners as part of a Bay Area water quality and water supply reliability initiative. As an existing reservoir operated by the Contra Costa Water District (CCWD), the Los Vaqueros Reservoir is subject to a number of mandates, agreements, and requirements in existing biological opinions. CALFED intends to work with CCWD and interested stakeholders to assure that previous commitments, including local voter approval required for expansion, are maintained (yr 1-7).
- Evaluate off-stream storage at Sites Reservoir, with a project capacity of up to 1.9 MAF (yr 1-5).
- Evaluate additional storage options in the upper San Joaquin River watershed. Consider additional storage capacity of between 250-700 TAF (yr 1-6).
- Evaluate enlarging Millerton Lake at Friant Dam or a functionally equivalent storage program in the region. The CALFED Program will join local partners to evaluate this project in Stage 1 (yr 1-6).

Power Facilities Re-operation Evaluation Evaluate the potential to re-operate some hydroelectric facilities to produce ecosystem benefits and water supply. The following ISI actions may be taken:

- Identify beneficiaries and negotiate cost sharing agreements (yr 1-7).
- Work with CALFED Agencies, the Public Utilities Commission, the SWRCB, the Federal Energy Regulatory Commission, and interested stakeholders to identify re-operation opportunities (yr 1-2).

- Develop environmental documentation on re-operation (yr 3-5).
- Perform feasibility studies and economic analyses (yr 3-5).
- Obtain permits, negotiate operating agreements, and seek site specific authorization including section 7 authorization. This may require design of facilities modifications to accommodate new operational priorities (yr 5-7).

Fish Migration Barrier Removal Evaluations To compliment ERP efforts to improve fish passage, the ISI Fish Migration Barrier Removal Program will identify obstructions, such as small dams, and consider modification or removal in order to restore anadromous fish access to critical upstream spawning and rearing habitat. The following actions will be taken:

- Work with CALFED Agencies, the SWRCB, local water agencies, and interested stakeholders to identify opportunities for modification or removal of obstructions such as small dams (yr 1-2).
- Develop environmental documentation (yr 3-5).
- Perform feasibility studies and economic analyses (yr 3-5).
- Obtain permits, negotiate agreements, and seek site specific authorization as required. This may require design on facilities modifications or removal actions. (yr 5-7).
- Identify beneficiaries and negotiate cost sharing agreements (yr 5-7).
- Begin construction (if needed) and begin new operations if conditions and linkages are satisfied (yr 6-7).

Conveyance

The CALFED Program will evaluate a through-Delta approach to conveyance based upon the existing Delta configuration with some modifications. The CALFED Program will evaluate the effectiveness of this conveyance approach, and add additional conveyance and/or other water management actions if necessary. The initial through-Delta conveyance will be continually monitored, analyzed, and improved to maximize the potential of the through-Delta approach to meet CALFED Program goals and objectives, consistent with the CALFED Program's Solution Principles. In the event of a finding that a through-Delta conveyance system is inadequate to achieve CALFED Program goals and objectives, additional actions may be implemented. The CALFED Program may also evaluate and pursue: 1) an isolated conveyance facility (a canal connecting the Sacramento River in the northern Delta to the SWP and CVP export facilities in the southern Delta); 2) source water blending or substitution; and/or 3) other actions through supplemental programmatic analysis.

As part of the Conveyance Program, the CALFED Program has incorporated the south Delta and north Delta regions to address conveyance improvements and related problems in Stage 1. Conveyance improvements for the South Delta set forth in the Final Programmatic EIR/EIS are identified as allowing SWP export capacity to increase from the current authorized levels with seasonal increases, as authorized in Corps Permit PN5820A. The proposed increases would allow up to 8,500 cfs pumping in 2003 and ultimately up to 10,300 cfs at the end of Stage 1. The EIR/EIS identifies a number of measures that will be part of the conveyance modifications including new fish screens, ecosystem restoration as part of the ERP, permanent operable barriers or their functional equivalent in selected South Delta channels, and other measures.

Improvements in export capabilities will be accompanied by associated operations which will maintain diversion capabilities for south Delta water users and provide for fish protection. CALFED implementing documents set forth a schedule for securing appropriate regulatory permits and completing a project-specific operations plan that addresses the potential impacts of increased pumping. This plan will need to reflect the nature and timing of the construction and operation of new project facilities and implementation of ecosystem improvements, and a more specific project description following completion of additional planning and environmental studies.

Decisions to implement conveyance actions will be predicated upon completing site-specific feasibility studies and complying with all environmental review and permitting requirements. Individual conveyance projects pursued under the WMS will fully evaluate all alternatives during tiered environmental review and will fully analyze and address direct and indirect effects under section 7 or section 10 of the ESA. Operational rules and facilities needed for use of additional export capability will be determined during ESA consultation on the project-specific environmental documentation prepared for the various conveyance elements.

Proposed Conveyance Stage 1 Actions (South Delta)

The CALFED Program will evaluate the following Conveyance actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions in the Conveyance Program.

- Pursue construction and evaluation of a 500 cfs test facility at the Tracy Pumping Plant to develop best available fish screening and salvage technology for the intakes to the SWP and CVP export facilities (yr 1-7).
- Pursue authorization for construction of a new screened intake for Clifton Court Forebay for the full export capacity of the SWP (yr 1-7).

- Implement the Joint Point of Diversion for the SWP and CVP (yr 1-7).
- Evaluate and decide on whether to retain a separate CVP intake facility or to consolidate with the SWP facility. An intertie between Clifton Court Forebay and the Tracy Pumping Plant will be required if the export location is consolidated at Clifton Court Forebay and will be evaluated if exports continue at both locations. Also, evaluate and potentially implement an intertie between the projects downstream of the export pumps (yr 1-7).
- Evaluate increased SWP pumping by 500 cfs from July through September (yr 1-4).
- Facilitate interim SWP export flexibility up to 8,500 cfs, with appropriate environmental constraints including ESA requirements (yr 4).
- Obtain permits including ESA authorization to use full SWP capacity of 10,300 cfs, consistent with all applicable operational constraints, for water supply and environmental benefits (yr 7).
- For purposes of the project level environmental analysis for the South Delta Improvements, evaluate various operable barrier configuration alternatives or their functional equivalents. All barrier operations will be done in conjunction with water operations to avoid impacts to fish. Potential barriers include the installation of a permanent fish migration barrier at the Head of Old River, and the construction of three permanent flow control structures at Old River at Tracy, Middle River upstream of Victoria Canal, and at Grant Line Canal. The Grant Line Canal barrier would be constructed and operated in accordance with conditions and directions specified by the Service, CDFG, and NMFS. (yr 1-7).
- Monitor barrier effects on fish, stages, circulation, and water quality (yr 1-7).
- Evaluate the dredging of selected channel segments (yr 3-7).

Additional Actions Required During Stage 1 (South Delta)

- Implement south Delta ERP goals (yr 1-7).
- Consolidate, extend, and screen local agricultural diversions based on priority and initiate a screen maintenance program (yr 1-7).
- Develop a strategy to resolve regional water quality problems including actions to improve San Joaquin River DO conditions and the San Joaquin River drainage as described in the CALFED Program's Water Quality Program. Evaluate the feasibility of re-circulation of water pumped from the Delta by the CVP and SWP. If feasible, and consistent with the CALFED Program's ecosystem restoration goals and objectives, implement a pilot program (yr 1-7).
- Continue implementation of the Vernalis Adaptive Management Plan. Include development of a long-term plan describing actions of the San Joaquin River Group Authority to improve water management practices (yr 1-7).

Proposed North Delta Stage 1 Actions

- Evaluate and implement improved operational procedures for the Delta Cross Channel to address fishery and water quality concerns (yr 1-4).
- Evaluate a screened through-Delta facility with a diversion capacity of up to 4,000 cfs on the Sacramento River to improve drinking water quality in the event the Water Quality Program measures do not result in continuous improvement towards CALFED drinking water goals. This evaluation would consider the effectiveness of water quality measures and how to operate the Delta Cross Channel in conjunction with this new diversion structure to improve drinking water quality, while maintaining fish recovery. If the environmental review demonstrates that this diversion facility is needed to address drinking water quality concerns, and can be constructed and operated without adverse effects to anadromous and estuarine fish, construction may begin late in Stage 1 subject to section 7 authorization (yr 1-4).
- Evaluate opportunities to resolve local flood concerns and create tidal wetlands and riparian habitat by constructing new setback levees, improving existing levees, and dredging channels in the north Delta, especially the channels of the lower Mokelumne River system. Any proposed channel modifications would be consistent with the CALFED Program's current direction on Delta conveyance and ecosystem goals (yr 1-7).
- Facilitate regionwide coordination of all CALFED Program related projects in the north Delta region (yr 1-7).

Proposed Stage 1 Actions Throughout the Delta Region

- Evaluate how water supplies can best provide a level of public health protection equivalent to Delta source water quality of 50 parts per billion (ppb) bromide and three parts per million (ppm) TOC (yr 1-7). This will include an equivalent level of investigation and studies on all of the actions which could be used to achieve the CALFED Program's targets.
- Evaluate the CALFED Program's progress toward measurable water quality goals and ecosystem restoration objectives, with particular emphasis on fish recovery (yr 6-7).
- Conduct additional environmental review to determine if construction of an isolated conveyance facility component of a dual Delta conveyance (presently not an element of the CALFED Program's Preferred Program Alternative) is warranted. A decision to construct such a facility would require separate environmental review and alternatives analysis that has not been done as part of the CALFED Program's programmatic analysis (yr 1-7).

Additional Actions Required During Stage 1 (Throughout the Delta Region)

- Fully implement actions, consistent with the MSCS, that mitigate for the direct and indirect environmental affects of project features and actions (yr 1-7).
- Improve flood control through levee improvements, levee setbacks, channel dredging, and floodplain restoration to be fully consistent with regional ERP actions (yr 1-7).
- Screen agricultural intakes to assure ecosystem protection (yr 1-7).

Environmental Water Account

An essential goal of the CALFED Program is to provide increased water supply reliability to water users while at the same time assuring the availability of sufficient water to meet fish protection and restoration\recovery needs as one part of the overall ERP. As a means to achieve these objectives, the CALFED Program will provide commitments under the ESA and CESA to SWP and CVP export facilities only for the first four years of Stage 1. These commitments are based on fully providing water from existing regulatory means, a fully implemented EWA, flows and habitat restoration provided through the ERP, and the ability to obtain additional assets should they be necessary.

The EWA is a new water source provided to: (1) augment instream flows and Delta outflows; and (2) reduce Delta exports from CVP/SWP export facilities during key periods of fish and aquatic ecosystem concerns. The CALFED Agencies will also continue to work with other diverters in the Delta watershed to resolve local fishery-diversion conflicts based on the site-specific needs and opportunities for each diversion. The CALFED Agencies have crafted the EWA so that it has no effect on the existing water rights of other water right holders in the watershed.

Overall Purpose, Framework and Administration. The EWA will be established, as part of the EWA Operating Principles Agreement (see Appendix E, hereby incorporated as part of this project description), to provide water for the protection and recovery of fish in addition to water available through existing regulatory actions related to project operations. The EWA Operating Principles Agreement will be interpreted to be consistent with this project description. To the extent that the EWA Operating Principles Agreement provides greater specificity, the EWA Operating Principles Agreement will be the controlling document.

The EWA will be funded jointly by the State and Federal governments and will be authorized to acquire, bank, transfer and borrow water and arrange for its conveyance. EWA assets will be managed by the State and Federal fishery agencies (the Service, NMFS, and CDFG) in

coordination with project operators and stakeholders. Initial acquisition of assets for the EWA will be made by Federal and State agencies (Reclamation and DWR). Subsequently, it is anticipated that acquisitions may be made pursuant to a public process that may take advantage of other agencies or third parties to acquire assets.

Baseline Level of Protection. DWR and Interior will provide a baseline of environmental protection. The CALFED Agencies recognize that the SWRCB may adjust the CVP and SWP responsibilities for complying with the 1995 Delta Water Quality Control Plan (WQCP), as part of its on-going Bay-Delta Water Rights Hearings. The outcome of those hearings may affect the nature of this baseline. The CVP's and SWP's regulatory baseline, primarily for fish needs, identified as Tier 1 in the EWA discussion below, will include:

- **1993 Winter-run Salmon Biological Opinion (NMFS)**

- **1995 Delta Water Quality Control Plan (SWRCB)**
  At this time, the SWP and CVP are responsible for meeting flow related objectives contained in this plan. The CALFED Agencies recognize that the SWRCB may adjust or re-allocate the responsibilities for meeting the 1995 Delta Water Quality Control Plan, as part of its ongoing Bay-Delta Water Rights hearings. Adjustment of responsibility to meet the standards will not affect the baseline level of protection for purposes of the EWA.

  The appropriate CALFED Agencies will develop a strategy to deal with the rare circumstances when the CVP obligation under the WQCP exceeds the 450 TAF annual cap for use of CVPIA Section 3406(b)(2) water. In the strategy, to be developed in conjunction with part of the Governor's Drought Contingency Plan, the Agencies will use their available resources to create an insurance policy to eliminate impacts to water users, while not adversely affecting other uses.

- **1995 Delta Smelt Biological Opinion (Service)**
  The export curtailment contained in the 1995 Delta Smelt Biological Opinion (item 2 on page 19), commonly referred to as the "2 to 1 Vernalis flow/export ratio", will be met by Section 3406(b)(2) of the CVPIA and EWA. This objective calls for the SWP and CVP to reduce combined exports, below what is allowed in the 1995 Water Quality Control Plan during a 31-day period in April and May. The 1995 WQCP allows exports to be 100% of the base San Joaquin River flow at Vernalis during the April-May pulse period. The CVP reduction in pumping will be conducted pursuant to the accounting policy for Section 3406(b)(2) of the CVPIA and/or through reimbursement by the EWA. The SWP

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will be reimbursed by the EWA for its participation in reducing exports pursuant to the 2 to 1 Vernalis flow/export ratio.

The CVP and SWP will be operated pursuant to the terms of the San Joaquin River Agreement through 2011. While the SJRA is in effect, the exports may be reduced beyond what is called for by the 2 to 1 Vernalis flow/export ratio and San Joaquin River flows may be augmented by water acquired from upstream sources during that same time period. Such an augmentation will not be included as part of the SWP share of Vernalis flow. While operating per the SJRA, the SWP and CVP will also receive reimbursement from the EWA or pursuant to Section 3406(b)(2) for the additional curtailment. If the SJRA is not implemented for any reason, the operations will default back to the biological opinion operation, as per the terms of the SJRA.

- **Full Use of 800 TAF Supply of Water Pursuant to Section 3406(b)(2) of the CVPIA in Accordance with Interior's October 5, 1999 Decision, clarified as follows**:

  Water Resulting from Refill of Reservoirs ("Reset"): Water which is available under the (b)(2) Policy as a result of refill of reservoirs following upstream releases ("reset") will not be used in a manner which results in increased export reductions. Upstream releases of (b)(2) water pumped by the SWP and made available to the EWA will not be subject to the "reset" provision.

  Export Curtailments which Result in Increased Storage ("Offset"): Where a prescribed (b)(2) export curtailment results in a reduction in releases from upstream reservoirs and hence increased storage, the charge to the (b)(2) account will be offset to the extent that the increased storage will result in increased delivery (beyond forecast delivery at the time of the export curtailment) to south-of-Delta CVP contractors in the remainder of the water year. If such deliveries cannot be increased in that water year, such additional water stored in upstream reservoirs shall be available for other (b)(2) uses without charge to the (b)(2) account. Where the delivery to export users in the remainder of the water year will not be increased and end-of-year storage will be increased, there will be no offset to the charge to the (b)(2) account.

The Secretary of the Interior is expected to make a decision later this year on Trinity River flows, pursuant to the original Trinity authorization, the Trinity Restoration Act of 1984, and the CVPIA. The substance of the decision is unknown and therefore cannot be addressed at this time.

Other Environmental Protections The regulatory baseline above also assumes that other environmental protections contained in biological opinions, regulations or statutes remain in place. These protections include, without limitation, Level 2 refuge water supplies, as required by the CVPIA. The CVP will use its share of the benefits from joint point of diversion, to the extent available, to provide water required by its Level 2 refuge water supply mandates, but using such benefits will not create any limitation on the Level 2 supply available for refuges.

Operational Rules The ground rules for operating the EWA are detailed in the EWA Operating Principles Agreement, executed by DWR, Reclamation, CDFG, the Service, and NMFS. The ground rules are based on the principle that the EWA will provide flows allowing fish recovery while not resulting in uncompensated reductions in deliveries to south of Delta CVP/SWP contractors.

Asset Development Immediate development of assets for the first year is critical to EWA success. Initial water purchases and lease of groundwater storage will be secured from willing sellers by the end of 2000. In addition to assets to be acquired annually, as shown in a following table, an initial one-time acquisition of 200 TAF of south-of-Delta storage or its functional equivalent will be acquired from a variety of sources to assure the effectiveness of the EWA and provide assurances for SWP and CVP water supply/deliveries. This initial deposit will also provide collateral for the first year's borrowing. The related storage is intended to function as long-term storage for other EWA assets as they become available.

Borrowing agreements will allow the EWA to borrow water from the CVP and SWP for necessary actions during a water year as long as the water can be repaid without affecting the following year's allocations. To the extent practicable, borrowing from the SWP and CVP will be shared. The limitations on borrowing will be developed as part of the agreement. Source shifting agreements with south-of-Delta water providers for 100 TAF will be used to enhance the effectiveness of the EWA, and to help provide assurance that SWP and CVP water deliveries will not be affected by EWA operations. To provide regulatory stability during the initial period of Stage 1, the CALFED Agencies will provide a commitment, subject to legal requirements, that for the first four years of Stage 1, there will be no reductions, beyond existing regulatory levels, in CVP or SWP Delta exports resulting from measures to protect fish under the ESA and CESA. This commitment will be based on the availability of three tiers of assets:

> **Tier 1** is baseline water, provided by existing regulation and operational flexibility. The regulatory baseline consists of the biological opinions on winter-run salmon and delta smelt, 1995 Delta Water Quality Control Plan, and 800 TAF of CVP yield pursuant to CVPIA Section 3406(b)(2).

Tier 2 consists of the assets in the EWA combined with the benefits of the ERP and is an insurance mechanism that will allow water to be provided for fish over and above Tier 1, when needed without reducing deliveries to water users. Tier 1 and Tier 2 are, in effect, a water budget for the environment and will be used to avoid the need for Tier 3 assets as described subsequently.

Tier 3 is based upon the commitment and ability of the CALFED Agencies to make additional water available should it be needed. It is unlikely that assets beyond those in Tier 1 and Tier 2 will be needed to meet ESA requirements. However, if further assets are needed in specific circumstances, Tier 3 will be provided. In considering the need for Tier 3 assets, the fishery agencies will consider the views of an independent science panel. Although the CALFED Agencies do not anticipate needing access to Tier 3 water assets, the CALFED Agencies will prepare an implementation strategy for Tier 3 by August 2001, establish a timely scientific panel process, and identifying tools and funding should implementation of Tier 3 prove necessary.

Table 2. List of EWA assets. Some assets may be replaced by functional equivalents, if determined to be appropriate by the EWA Managing Agencies (Service, CDFG, NMFS)

Action Description	Water Available Annually(Average)
SWP Pumping of (b)(2)/ERP Upstream Releases[1]	40,000 acre-feet[2]
EWA Use of Joint Point[3]	75,000 acre-feet
Export/Inflow Ratio Flexibility	30,000 acre-feet
500 cfs SWP Pumping Increase	50,000 acre-feet
Purchases - South of Delta	150,000 acre-feet
Purchases - North of Delta[4]	35,000 acre-feet
TOTAL	380,000 acre-feet
Storage acquisition	200,000 acre-feet of storage, filled when acquired in Year 1
Source-shifting agreement	100,000 acre-feet at any time

[1]The EWA and the SWP will share equally the (b)(2) and ERP upstream releases pumped by the SWP after they have served their (b)(2) and ERP purposes.

[2]The amount of water derived from the first four actions will vary based on hydrologic conditions.

[3]The EWA will share access to joint point, with the CVP receiving 50% of the benefits.

[4]This is the amount of water targeted for the first year; higher amounts are anticipated in subsequent years.

CALFED Science Program

The CALFED Science Program includes implementing the Comprehensive Monitoring, Assessment, and Research Program (CMARP) as an integral aspect of the overall CALFED Program. The scope of the Science Program will encompass all elements of the CALFED Program: ecosystem restoration, water supply reliability, water use efficiency and conservation, water quality, and levees integrity. The purpose of the Science Program is to provide new information and scientific interpretations necessary to implement, monitor, and evaluate the

success of the CALFED Program. The Science Program will build on the work of the Interagency Ecological Program and other scientific efforts in the CALFED Program area.

The CALFED Program is organized around the concept of adaptive management because there is incomplete knowledge of how the ecosystem functions, the effects of human stressors on ecosystem structure and function, and the ecological and other effects of individual CALFED Program actions. Monitoring key system functions (or indicators), completing focused research to obtain better understanding, and staging implementation based on information gained are all central to the adaptive management process.

In order to better integrate scientific review into the CALFED Program, the Governor and the Secretary of the Interior will appoint an independent science board to provide oversight and peer review for the overall program. Also, specific independent science panels may be convened as standing bodies or on an as needed basis. For example, the Science Program will assist with convening an independent science panel to review implementation and operation of the EWA. In addition, the existing ERP Interim Science Board will likely become the ERP Science Panel, and provide ongoing independent review of the ERP.

Proposed Science Program Stage 1 Actions

The CALFED Program will evaluate the following Science Program actions proposed for implementation in Stage 1. These proposed Stage 1 actions are representative of the overall set of proposed actions for the Science Program.

- Periodic review and refinement of the monitoring, data assessment and research plan from a long term perspective (yr 1-7).
- Periodic review and refinement of the monitoring, data assessment and research plan from a short term perspective which would include all elements of the Phase III, Stage 1 Program (yr 1-7).
- Help management define triggers and time periods which determine the need for a change in program direction (yr 1-7).
- Continue to develop and refine conceptual models to be used in evaluating actions undertaken by the programs. In keeping with the adaptive management format, the models will be continually updated with information generated by program actions (yr 1-7).
- Evaluate the effectiveness of the adaptive management process on the program decision making process (yr 1-7).

- Review the progress toward achieving overall CALFED Program goals and objectives and whether individual programs are progressing at similar paces (yr 1-7).
- Complete monitoring identified by the Diversion Effects on Fisheries Team to provide feedback on actual diversion effects of south Delta pumps (yr 2-7).
- Design long-term, system wide, baseline monitoring with focused research to increase understanding of ecological processes and ways to reduce uncertainty; definition of needed studies is currently under development (yr 1-7).
- Provide available data on need to reduce bromides, total dissolved solids, total organic carbon, pesticides and heavy metals (yr 5).
- Provide available data on water quality in the south Delta and lower San Joaquin River (yr 1-7).
- Monitor and assess the impacts of water use efficiency measures on water demands and available supplies, and develop better information for water balances in the Bay-Delta system (yr 1-7).
- Prepare annual reports on status and progress, including such information as: status of the species and effectiveness of efforts to improve conditions, including EWA, ERP and water management strategies, and provide recommendations to maximize fishery benefits while minimizing impacts to water supply (yr 1-7).
- Analyze status and need for adjustments of actions for later stages (yr 5-7).
- Monitor and report land use changes, such as agricultural land conversion, resulting from CALFED Program actions (yr 2-7).
- Hire an interim science leader and subsequently hire a chief scientist (yr 1-2).
- Appoint an Independent Science Board and an independent science panel for the EWA (yr 1-2).
- Coordinate existing monitoring and scientific research programs (yr 1-7).
- Refine the set of ecological, operational, and other predictive models that will be used in the evaluation process (yr 1-2).
- Establish and refine performance measures and indicators for each of the program areas (yr 1-7).

Multi-Species Conservation Strategy

The MSCS serves as a biological assessment for the CALFED Program and describes the CALFED Program strategy for achieving compliance with the ESA, CESA, and Natural Community Conservation Planning Act during implementation of the CALFED Program. As a biological assessment, it summarizes the CALFED Program and analyzes its effects on 244 listed, proposed, and candidate species, and species of concern. As a "conservation strategy" it outlines

conservation goals for species that will be effected by the Program, and identifies strategies for achieving those goals and ESA compliance.

Conservation Goals and Prescriptions

The MSCS identifies conservation goals for 244 species as well as species prescriptions and conservation measures to achieve these goals. The CALFED Program has established a goal to recover 19 species, contribute to the recovery of 25 species, and maintain 200 species. A goal of "recovery" was established for those species whose recovery is dependent on restoration of the Delta and Suisun Bay/Marsh systems. Recovery is achieved when the decline of a species is arrested or reversed, threats to the species are neutralized, and the species long-term survival in nature is assured. Recovery is equivalent, at minimum, to the requirements for de-listing a species under ESA and CESA. The goal "contribute to recovery" was assigned to species for which CALFED Program actions affect only a limited portion of the species' range and/or CALFED Program actions have limited effects on the species. To achieve the goal of contributing to a species' recovery, the CALFED Agencies are expected to undertake some of the actions under its control and within its scope that are necessary to recover the species. The goal "maintain" was assigned to species expected to be minimally affected by CALFED Program actions. For this category, the CALFED Agencies will avoid, minimize, and compensate for any adverse effects to the species commensurate with the level of effect on the species. Actions may not actually contribute to the recovery of the "maintain" species; however, at a minimum, they will be expected to not contribute to the need to list a species or degrade the status of a listed species. The CALFED Agencies will also, to the extent practicable, improve habitat conditions for these species.

Specific prescriptions were developed to achieve the conservation goals described above for each species. The prescriptions incorporate the measures identified in State and Federal recovery plans, where available, other relevant information, and professional judgment. Prescriptions include measures to enhance habitats and species and are not directly linked to the CALFED Program's adverse impacts.

As the CALFED Program proceeds during the next 30 years, it is anticipated that California's landscapes could change significantly and that new information will be available through research and monitoring. Consequently, species goals and prescriptions will likely change through time through adaptive management, and as new recovery plans are finalized or updated.

Framework for Federal Endangered Species Act Compliance

The CALFED Agencies will take actions necessary to meet the following conditions: 1) the fishery protections elements of the Program must be implemented as described in the EIS/EIR, including the ERP and EWA implementation and funding commitments (at least $150 million annually for the ERP, and an additional $50 million annually for the EWA); 2) Tier 3 measures must be provided, if and when needed; and, 3) implementation of the milestones must be demonstrated; and 4) the initial and annual assets of the EWA must be acquired for the EWA.

The program will be continuously monitored to ensure that it is implemented as intended and the elements necessary for regulatory commitments, i.e., conditions as described in the Conservation Agreement are implemented. In the event that information from monitoring or any other source indicates that any of the Program elements necessary for regulatory commitments are not being met or will not be met, notification will be provided, by the agency which developed the information, to the affected Agencies, as appropriate. Upon notification, the affected agencies will meet promptly to identify and assess measures which can be taken to remedy any noncompliance or anticipated noncompliance with the conditions, and will immediately implement measures. If the Service determines that a situation of noncompliance exists and the affected agencies are unable to remedy noncompliance within a reasonable time period that the Service prescribes, not to exceed 60 days, the regulatory commitments will be suspended or terminated. Upon a determination of noncompliance, formal consultation will be reinitiated and the Service will issue a new or amended biological opinion with conditions prescribing alternative regulatory requirements. If the compliance with the conditions set out above is subsequently achieved, the initial regulatory commitments may be revised and reflected through new or amended programmatic biological opinions. Nothing described here will affect the Service from exercising our regulatory authority.

There are several issues that have been subject to interpretation in the 1995 delta smelt opinion relating to OCAP. These issues will need to be resolved pursuant to any reinitiation of section 7 consultation concerning the joint operations of the CVP and SWP should the EWA not be fully implemented. These issues include but may not be limited to 1) the amount of allowable exports during the San Joaquin River pulse flow in April-May, either under the VAMP or the WQCP Vernalis flow requirements, 2) the amount or extent of actions that must be taken at the "yellow light" stage of incidental take to avoid or minimize the direct and indirect effects of project operations and to avoid reaching "red light", and 3) other actions that may be deemed necessary at the time of reinitiation to provide the regulatory protection for delta smelt, Sacramento splittail, spring run chinook salmon, and steelhead.

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The MSCS describes program-level strategies to achieve compliance with ESA, including strategies to address the indirect effects of actions taken under the CALFED Program, and strategies for completing tiered consultations, when appropriate. The CALFED Program's compliance strategies will, in part, be developed and implemented as part of future CALFED Program projects tiered from this programmatic biological opinion.

Entities implementing CALFED Program actions which may effect listed species will be required to develop ASIPs. ASIPs will be developed for individual CALFED Program actions or groups of actions when enough detailed information is available about the actions to analyze fully their impacts on species and habitats, and develop appropriate measures to avoid, minimize, and compensate for impacts. Specifically, individual projects that qualify for consultation will be evaluated within the context of the program as a whole, which includes major elements designed to improve the environmental baseline and lead to the recovery of targeted species. These major elements will be subject to on-going monitoring, evaluation, and the application of adaptive management. Site specific biological opinions will take into account the environmental benefits that accrue from the CALFED Program.

Development of ASIPs will be coordinated with the wildlife agencies so that the particular set of measures necessary to be implemented to achieve FESA compliance will be incorporated as part of the proposed ASIP. The particular set of measures included will likely be unique to each ASIP. The MSCS describes programmatic avoidance, minimization, and compensation measures to be incorporated into ASIPs. However, ASIPs also may include additional measures not described in the MSCS, and possibly a set of ERP actions. For example, a levee improvement project in the Delta may include a particular set of MSCS avoidance, minimization, and compensation measures, additional measures unique to the proposed project, and ERP actions to restore wildlife habitat adjacent to or on the improved levee. ASIPs will be reviewed for compliance with the ESA through the section 7 consultation process, or through the section 10 habitat conservation planning process.

Service Area Effects

Implementation of the CALFED Program's Preferred Program Alternative related to water supply reliability will be determined largely in an incremental fashion through an adaptive management process. Because of this, it is not possible to accurately estimate the scope of potential service area effects on species and habitats. Project-level or site-specific impacts may not be known until Phase III of the CALFED Program (implementation). Therefore, the CALFED Program strategy for addressing indirect effects in the service areas includes identifying a short-term strategy based

on critical species needs for recovery and restoration, and a long-term strategy for dealing with impacts that cannot be predicted when the biological opinions are issued.

CALFED Agencies will use a two-step process to address potential service area effects that are currently unknown. First, CALFED Agencies will determine the potential presence and scope of any service area effects. Then, to address the effects it has identified, CALFED Agencies will integrate proactive, conservation planning approaches with specific conservation measures. To do this, CALFED Agencies will develop the four conservation measures listed below during Phase III.. These measures, as described in the MSCS on pages 4-17 and 4-18, attempt to address these effects at the project level and at the program level.

- Providing technical assistance and other support to entities preparing Habitat Conservation Plans (HCPs) or conservation programs addressing effects of land use changes in the service areas.
- Evaluating each future water supply reliability program or project during planning and including appropriate measures to address indirect effects in the ASIPs. This may include implementing the applicable conservation measures already in the MSCS to conserve species relative to service area effects or developing new measures.
- Developing or contributing to conservation programs to address the critical needs of species in CALFED Program service areas not already covered by conservation plans.

Governance Plan

The interim governance structure will be in place from the time of the Programmatic ROD until a long-term permanent structure is adopted through State and Federal legislation. For interim governance, CALFED Agencies propose adoption of the current CALFED Program structure being used during the planning stage, but adapted for implementation. The interim governance structure, including identification of how decisions will be made, will be set forth in a new Implementation MOU which the agencies will develop and execute by the time of the ROD. The current structure is made up of the Policy Group reporting to the Governor of California and the Secretary of the Interior, public advisory groups, the CALFED Program Executive Director and staff, and State and Federal agencies and teams. This structure, with additions and modifications, will serve to bridge the gap until a permanent commission is established.

Interim Program Management Responsibilities The Levee System Integrity Program management will remain with DWR, CDFG, and other existing agencies. The CALFED Program will continue to manage the ERP, in coordination with the appropriate agencies. The State and Federal fishery agencies (CDFG, Service, NMFS) will manage the EWA assets, in coordination with the ERP and

water project operations (Reclamation and DWR). CALFED Program will be assigned program management for the Watershed Program. The CALFED Program and appropriate agencies (such as Reclamation, EPA, DHS, DWR, and SWRCB) will manage the Drinking Water Quality Program. For the Water Transfer Program, CALFED Program will provide program direction, oversight, and coordination among CALFED Program areas and among agencies with jurisdiction over water transfers and use of project facilities. Agencies with jurisdiction over water transfers would retain authority to implement any changes in their own policies or procedures. DWR, Reclamation, and CALFED Program will manage the Water Use Efficiency Program. DWR, Reclamation, and CALFED Program will manage the Storage Program Element. DWR and Reclamation will manage the Conveyance Program element. CALFED Program will manage the Science Program (as consistent with the Implementation MOU).

Milestones

Milestones are a list of ERP, MSCS, and Water Quality Program actions the CALFED Program will fully implement in Stage 1 to address covered species. Milestones are a subset of the ERP actions the fish and wildlife agencies expect will be implemented in Stage 1, to achieve the Program's conservation goals. The complete list of milestones appears in Appendix J. A full description of the function and significance of the milestones to this consultation is included in the Appendix.

The Program's objectives for ecosystem restoration are to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse plants and animal species. The ERP, MSCS, and WQP are the principal Program elements designed to meet these objectives. Implementation of the ERP will be informed by the Science Program, which will conduct pertinent research, and monitor and evaluate the implementation of ERP, MSCS, and WQP actions. The ERP, MSCS, WQP, and the Science Program are directly relevant and important for FESA, CESA and NCCPA compliance. To ensure that the ERP, MSCS, and WQP are implemented in a manner and to an extent sufficient to sustain programmatic FESA, CESA and NCCPA compliance for all Program elements, the USFWS, NMFS and CDFG (the Fish and Wildlife Agencies") have developed Milestones for ERP, MSCS, and WQP implementation. The Milestones include Science Program actions that are relevant for ERP, MSCS, and WQP implementation. The Fish and Wildlife Agencies have concluded that the Milestones, if achieved along with expected additional ERP actions , define an adequate manner and level of ERP, MSCS, and WQP implementation for Stage 1.

The ERP, MSCS, and WQP are the Program's blueprint for the restoration of the Bay-Delta. The MSCS is not a separate blueprint or supplemental restoration program and does not supplant the ERP. The measures and goals in the MSCS are consistent with the ERP's measures and goals. However, the MSCS is a conservation strategy and a regulatory compliance strategy for the entire Program. The MSCS addresses the potential adverse effects and beneficial effects of all Program actions, including ERP actions and other Program actions such as levee system integrity actions, water conveyance actions and storage actions. Based in large part on the ERP, the MSCS' premise is that the Program as a whole, including all Program elements, will improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta. The ERP therefore serves two purposes: 1) to achieve Program objectives for ecosystem restoration and species recovery, and 2) to enable actions from all Program elements to be completed in compliance with FESA, CESA and the NCCPA through implementation of ASIPs.

To serve both of these purposes, ERP implementation must be informed both by the best available scientific information and by information about the implementation of other Program actions. Information about the implementation of other Program actions is necessary to ensure that they do not conflict or limit the success of the ERP. In addition, ERP restoration actions must be implemented concurrent, and at a commensurate level, with the implementation of other Program actions to ensure that the Program as a whole continues to increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta. The Milestones are intended to establish, based on the best information currently available, a group of actions derived from the ERP, MSCS, and WQP that 1) establish an adequate level of implementation during Stage 1, 2) would not be inhibited by proposed Stage 1 actions in other Program elements, and 3) would enable proposed Stage 1 actions in other Program elements to be completed in compliance with FESA, CESA and the NCCPA through implementation of ASIPs.

The Program's development of annual, near-term, and long-term ERP implementation priorities and strategies will be based on the goals and objectives of the ERP Strategic Plan, the MSCS, FESA recovery plans, and implementation plans developed for specific ecological management zones, and will be informed by the Science Program. The Milestones represent the MSCS' goals and objectives with respect to the ERP. As with ERP implementation priorities and strategies generally, the Fish and Wildlife Agencies intend that the Science Program will provide information concerning the Milestones. Specifically, the Fish and Wildlife Agencies will seek review within the Science Program of 1) whether other Program elements conflict with implementation priorities and strategies so as to limit the success of the ERP, MSCS, and WQP, and 2) whether the implementation priorities and strategies will ensure that the Program as a whole continues to increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta. As the

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Science Program develops information about implementation, the USFWS, NMFS and CDFG will revise the Milestones as necessary, consistent with the FESA and the NCCPA.

The CALFED Program will develop annual ERP implementation plans using the ERP Strategic Plan for Ecosystem Restoration and the MSCS. Members of the Science Program, the Agency/Stakeholder Ecosystem Team ("ASET") the CALFED Program will work cooperatively to develop annual ERP implementation plans and to define the long-term priorities for the ERP. The Fish and Wildlife Agencies will participate fully in the process for developing annual ERP implementation plans. The Fish and Wildlife Agencies' participation will include, but not be limited to, participation in the ASET. Through participation in the annual ERP implementation plan process, the Fish and Wildlife Agencies will help ensure 1) that each plan is based on the best available information regarding ecosystem restoration and the Bay-Delta system, 2) that each plan will achieve substantial progress toward meeting the Milestones, and 3) that the Science Program will provide information to achieve applicable Milestones. As new information becomes available and conceptual models are tested and refined as part of this process, the Fish and Wildlife Agencies anticipate that priorities reflected in the Milestones may change, and that new issues or questions may emerge. Through the annual ERP implementation process, Science Program members, the CALFED Program, and ASET members may propose revisions to the Milestones based on pertinent new information. If the Fish and Wildlife Agencies determine that the proposed revisions are warranted and are consistent with FESA and the NCCPA, the Fish and Wildlife Agencies will revise the Milestones accordingly.

The Fish and Wildlife Agencies will not approve revisions to the Milestones that would cause or allow an effect to Covered Species or critical habitat designated under FESA that was not considered in the programmatic regulatory determinations, or would otherwise require the re-initiation of consultation under 50 CFR §402.16. Consequently, the USFWS and NMFS expect that their approved revisions to Milestones can be incorporated in each agency's programmatic biological opinions without re-initiating consultation under §7 of FESA. CDFG will incorporate its approved revisions to the Milestones by amending the CDFG Approval and Supporting Findings for the MSCS.

It will not be possible to gauge the progress of Milestone implementation for a few years, once Phase III begins. Consequently, over the first four years the Wildlife Agencies will base success of Program Implementation upon the criterion that the ERP is fully funded (at least $150 million from dedicated funding sources annually through Stage 1 for the ERP, and an additional $50 million EWA funding annually for the first four years). However, the criterion for success at the end of Stage 1 will be implementation of the Stage 1 Milestones.

The Program will submit an annual report to the Governor, the Secretary of the Interior, the State Legislature and the Congress that describes the status of implementation of all Program elements by December 15 of each calendar year. The report will document the status of all actions taken to meet Program objectives in Stage 1. Among the actions addressed in the report will be the completion of key projects and milestones identified in the ERP. Progress in achieving the ERP-MSCS Milestones will be included in the portion of the annual reports concerning the ERP.

Summary of Key Planned Actions

If key program actions are not implemented at this programmatic level, or new information becomes available, consultation would be reinitiated at the programmatic level to ascertain how the lack of implementation of any actions, or new information, affects the evaluation of effects upon listed species associated with the overall implementation of the suite of actions being considered and the subsequent conclusions made in this biological opinion. The following key actions are considered relevant to this biological opinion and part of the project description and, are therefore, requisite in conducting the effects analysis:

Program-wide

1. The conservation actions described in the Description of the Proposed Action will be implemented, including, but not limited to, the Ecosystem Restoration Program Plan, the Water Quality Program Plan, the Watershed Program Plan, and the Multi-Species Conservation Strategy and, where applicable, its strategy for addressing indirect, service area effects. The determination of whether and to what extent a specific action results in indirect effects will be made on a case-by-case basis in accordance with legal requirements. These actions will be implemented consistent with the Science Program and adaptive management, as described in the **Description of the Proposed Action**.

2. CALFED Agencies will obtain funding sufficient to implement the conservation elements and strategies, as necessary, to implement this biological opinion.

3. The various CALFED Program elements, strategies, and projects will be implemented in concert with the ERP, MSCS, EWA, and WQP to achieve the multiple goals of the CALFED Program. The CALFED program will be implemented such that the net effects to species and their habitats are positive and are consistent and in conformance with State and Federal recovery plans.

4. To the extent that a CALFED action is not subject to section 7 and is likely to result in take of a listed species, a section 10 permit will be required.

5. The CALFED Program will utilize comprehensive monitoring and adaptive management to assess projects and programs.

6. The CALFED Program will implement projects to achieve the milestones (Appendix J) established for the ERP, MSCS, and WQP.

7. Discharges into surface water bodies and waterways resulting from CALFED Program actions will comply with the standards set forth in the Description of the Proposed Action for the biological opinion on the Environmental Protection Agency's Promulgation of Numeric Criteria for Priority Toxic Pollutants for the State of California; California Toxics Rule (CTR) (Service File No. 1-1-98-F-21), in accordance with applicable implementation plans.

8. Entities implementing CALFED Program actions will comply with all applicable environmental laws.

9. DWR, to the extent required by law, and Reclamation will consult on all new and modified water contracts resulting from a CALFED Program action that may affect listed species.

Levee System Integrity Program

10. Levee integrity improvement elements will be consistent with ERP actions and MSCS conservation measures, so that levee integrity and ecosystem and species recovery advance simultaneously.

11. The Service, NMFS, and CDFG will be involved in planning Levee System Integrity Program projects to ensure that ERP implementation is not impaired by levee program actions and adverse effects of levee actions are fully mitigated.

12. Development and implementation of CALFED Program plans for rehabilitating Suisun Marsh levees will be consistent with the goals of the ERP and MSCS, including State and Federal recovery plans.

13. Levee repair/improvements will be constructed using levee set-backs and soft-fixes (bio-technical solutions) to the extent practicable.

Water Quality Program

14. The CALFED Program will implement projects to achieve the milestones established for the WQP in Stage 1.

Ecosystem Restoration Program

15. The CALFED Program will implement projects to achieve the milestones established for the ERP in Stage 1.

16. The ERP will be implemented in a manner that will achieve species prescriptions and recovery goals of covered species by year 30 of the CALFED Program. Stage 1 milestones establish the trajectory for achieving recovery goals for the first 7 years.

Water Use Efficiency Program

17. Development and implementation of the WUE will be consistent with the goals and objectives of the ERP and MSCS, including State and Federal recovery plans. Program actions and associated conservation measures will be planned in conjunction with the Service, NMFS, and CDFG, in compliance with FESA, CESA, and NCCPA, as appropriate. Program development will be coordinated with other CALFED Programs (WQP, ERP, MSCS, and Science Program).

Water Transfers Program

18. CALFED Program actions subject to the FESA that will result in the transfer of water that may affect listed species will not be undertaken until consultation under section 7 or a permit under section 10 is completed. In any such consultation, the fish and wildlife agencies will determine whether adverse effects are likely to occur. Additionally, the EWA will not be charged for curtailed 3rd party transfer opportunities.

19. EWA, CVP, and Level 4 Refuge water supply transfers resulting from CALFED actions will have priority for conveyance over other transfer obligations (as consistent with the Operating Principles Agreement, for the EWA).

Watershed Program

20. Development and implementation of the Watershed Program will be consistent with the goals of the ERP and MSCS, including State and Federal recovery plans. Program actions will be planned in conjunction with the Service, NMFS, and CDFG, in compliance with FESA, CESA, and NCCPA, as appropriate. Program development will be coordinated with other CALFED Programs (WQP, ERP, MSCS, and Science Program). Program actions will be funded so that it is assured that appropriate conservation measures for listed species will be included in program actions, as appropriate.

Water Management Strategy

Specific key actions are provided for storage, conveyance, EWA, and other programs.

Storage

21. Storage sites will be selected through a screening process which includes applicable environmental requirements.

22. Following the initiation of consultation, CALFED Agencies will comply with section 7(d) of the ESA, which prohibits making any irreversible or irretrievable commitment of resources, for any potential new storage site or modified storage site prior to achieving project-specific compliance under section 7(a)(2) of the ESA.

23. Tiered project specific analyses of potential storage improvements will identify and result in the selection of alternatives that are capable of being mitigated with appropriate mitigation sites and operational requirements; where the compensatory mitigation is highly likely to be successful; with the project specific compensatory mitigation implemented concurrent with, or in advance of, the adverse effects associated with construction and implementation of the project; where construction and operation of the project will not result in jeopardy to listed or proposed species or adverse modification of critical habitat; and where the project will not result in substantial degradation of the aquatic environment.

24. Any and all conveyance structures (e.g., canals, pipelines), recreation, roads, and similar developments associated with or proposed in conjunction with proposed expansions of existing storage facilities or proposed new storage facilities will be evaluated thoroughly for their impacts to Federal or State listed species and those species evaluated consistent with the MSCS. If, through the informal or formal consultation process, it is determined by the Service, NMFS, and CDFG (for State listed species) that project-related impacts would threaten the long-term viability of Federal or State listed species or those species

evaluated under the MSCS, the proposed project(s) will be modified or dropped from consideration.

Conveyance

25. To the extent consistent with the Service's regulatory authority, any CALFED Agency that proposes to develop water for delivery or application outside current contract service areas would comply with ESA requirements under section 7 or 10, as appropriate, if listed species may be affected.

26. In proceeding with the South Delta Improvement Program, CALFED Agencies shall implement ecosystem restoration in the lower San Joaquin river and south Delta (generally, south of Empire Cut) in advance of or concurrent with impacts resulting from south Delta facility improvements.

27. When the CDFG, NMFS and Service, in consultation with the CALFED Agencies, determine that a diversion requires screening, CALFED Agencies will secure written agreements from willing land owners to allow access for screening of agricultural and municipal diversions to protect fish consistent with the screening priorities established by the CALFED Program. The agreement will provide that if monitoring is necessary, access for monitoring will be allowed with reasonable notification. If the CALFED Program is not substantially achieving screening program objectives, the CALFED Agencies will reinitiate informal or formal consultation.

28. When implementing EWA export reductions, the water cost associated with decreased exports will be charged against current facilities capabilities as constrained by current regulation. Any future increases in exports resulting from CALFED conveyance improvements will have operational rules developed through consultation with the fish and wildlife agencies to ensure consistency with EWA Operating Principles, and the goals of restoration and recovery for aquatic species.

29. In the interim, prior to installation of permanent operable barriers, DWR will apply for and obtain permits to allow the continued operation of the temporary barriers.

30. Prior to increasing pumping above current authorized levels, operational rules for use of additional export capability will be determined through an open CALFED process and ESA consultation on the project-specific environmental documentation prepared for the various conveyance elements. To offset potential impacts and to provide for recovery of

fishery populations, additional measures will be developed which would allow for protection of fish. These additional measures, which are phased over time, may include, but are not limited to (a) screening, (b) new standards which limit the timing and magnitude of exports and water supply releases at key periods of fish concern, or (c) a combination of the two. ESA coverage for such actions would come from separate consultation for OCAP or in consultations tiered from this opinion.

31. An isolated conveyance facility will be evaluated as an alternative in the event it is determined that a through-Delta system will not accomplish the CALFED Programs' goals for restoration and recovery of listed species, or its WQP goals. The study will be developed through a peer-review process to ensure objective analysis.

EWA

32. All EWA fixed assets (i.e., purchases) are acquired each year.

33. The EWA Operational Principles Agreement is signed and fully implemented.

34. The project agencies shall request clarification with the Service, CDFG and NMFS on any points that appear to be ambiguous related to fishery actions for the EWA.

35. If EWA assets are depleted and the Service, NMFS, and CDFG determine Tier 3 is necessary, Tier 3 assets will be available to protect fish.

36. As new water storage and conveyance projects are being planned, potential fishery impacts will be assessed. If necessary to offset potential impacts and to provide for recovery of fishery populations, operational rules will be developed which will provide for protection of fish. These operational rules may include but are not limited to (a) limits on the timing and magnitude of exports and water supply releases at key periods of fish concern, and (b) new sharing formulae to increase EWA assets, which would allow the EWA to offset impacts and implement restoration actions. ESA coverage for such actions would come from separate consultation for OCAP or in consultations tiered from this opinion, as appropriate.

Science Program

37. The Science Program will complete annual reports describing program progress and compliance of all CALFED program actions within this biological opinion.

Multi-Species Conservation Strategy

38. CALFED agencies will consult with the Service or request technical assistance, as appropriate, to determine whether any future CALFED Program actions (including water transfers and permanent assignment of water) may affect listed or proposed species before signing a ROD or a FONSI which is tiered from the PEIS. This determination will consider both direct and indirect effects, if any, of specific actions. Evaluation of whether and to what extent the specific action results in indirect effects will be made on a case by case basis in accordance with legal requirements.

39. The list of evaluated species will be reviewed and revised periodically by the Service, NMFS, and CDFG to add and remove species, as appropriate, and to review the recovery objective (R, r, or m) for species for their appropriateness.

40. The Service will work closely with other CALFED agencies, water users and others, providing them with maps of listed species habitats within service areas. The Service will guide entities through the consultation process or provide technical assistance, as appropriate, to address project-specific effects.

41. Entities implementing CALFED Program actions will complete tiered, project-specific consultation with the Service, NMFS, and CDFG, as appropriate, through completion of Action-Specific Implementation Plans, as described in the MSCS.

42. The CALFED agencies will closely coordinate with the Service, NMFS, and CDFG during development and implementation of all ASIPs.

43. To the extent that the CALFED Program actions result in changes to land use practices and the impact analysis required by the MSCS shows effects to listed species, ESA, CESA and NCCPA compliance, as appropriate, will occur. The strategy for addressing impacts as described in the MSCS includes appropriate tools such as: (1) assisting with or contributing to completion and implementation of HCPs that address service area effects, as described in section 10(a) of the ESA; (2) including measures to address indirect effects in ASIPs and completing project-specific section 7 consultations on the ASIPs; (3) contributing towards or developing and implementing a conservation program that addresses species critical needs; and implementing the applicable conservation measures, relative to service area impacts, already in the MSCS.

44. The CALFED Program will monitor the baselines of the species addressed in this opinion. Monitoring (for the life of the CALFED Program's Preferred Program Alternative) will be implemented immediately to test and track the CALFED Program's objective that species' baselines are stable or increasing.

45. Any project-specific effects to listed species will be consulted upon following project-specific analysis and prior to the effect, and the CALFED agencies shall be adequately funded and staffed to complete tiered project-specific consultations from this opinion and track implementation of conservation actions.

Environmental Baseline

Most of California's threatened and endangered species depend on native habitats that are declining in area and quality. Because these sensitive habitats may host threatened and endangered species, their loss or degradation can often adversely affect multiple species. Factors contributing to the environmental baseline are therefore grouped by habitat type in the analysis below. However, effects from environmental contaminants are typically less specific to particular habitats and are discussed separately. Population status for individual species is described in the species accounts found in Appendix C.

When the CVP began operations, approximately 30% of all natural habitats in the Central Valley had already been converted to urban and agricultural lands. This included loss of more than 80% of the riparian vegetation along the Sacramento River. By the time Shasta Reservoir (the first large CVP facility) began operation in 1944, many of California's natural habitats had been altered dramatically.

Habitat Analyses

Acreage trends in the analyses below are based primarily on Küchler (1977) and GAP (1996). Küchler's (1977) map of California's potential natural vegetation (i.e., the potential climax vegetation which exists or has been estimated to exist and would occur if all alterations and disturbances to the respective environments, except reservoirs, were removed) was digitized into Geographic Information System (GIS) format. GAP (1996) included digital information about extent and distribution of habitats from 1990 LANDSAT Thematic Mapper satellite imagery. The minimum mapping unit in GAP data is 100 hectares (247 acres) for upland habitats and 40 hectares (99 acres) for wetland habitats. Because comparisons of acreage figures between the two studies are complicated by differences in habitat classification, percentage changes are approximate. In particular, the areas delineated as potential wetlands by Küchler (1977)

historically included habitats such as the large lakes of the Tulare Basin, which may be more comparable to the "open water" category of GAP data. Conversely, Küchler (1977) included artificial reservoirs in his map that did not exist prior to European settlement. Definitions of barren/alpine habitat also differ between the two studies. However, the two studies differ in estimation of total acreage by less than 0.1%. The estimated trends in habitat are identified in Table 3.

Delta Aquatic

Habitat Description and Associated Species

The Delta is the uppermost part of the Sacramento-San Joaquin Estuary and is largely a tidally influenced freshwater system. During high flows of fresh water from the Sacramento and San Joaquin Rivers, the mixing zone between fresh and salt water is pushed downstream toward the Golden Gate. The position of the freshwater edge of the mixing zone (also known as X2), where the salt content (salinity) of the water is 2 parts per thousand, is determined by river flows and tides. Plankton (microscopic organisms floating in the water column) are most abundant in the mixing zone, so the vicinity of X2 is high-quality habitat for adult and larval fish that feed on plankton. Shallow aquatic habitats have been identified in the Delta Native Fishes Recovery Plan (Service 1996a) as essential to the long-term survival and recovery of Delta smelt and other resident fish. When the mixing zone is below the Delta in Suisun Bay, a large area of suitable shallow water habitat is in the mixing zone and water temperatures are favorable for growth of plankton.

Federally listed species associated with Delta aquatic habitats include Delta smelt (*Hypomesus transpacificus*), tidewater goby (*Eucyclogobius newberryi*), and Sacramento splittail (*Pogonichthys macrolepidotus*). Listed bird species, such as the California least tern (*Sterna antillarum browni*), or California brown pelican (*Pelecanus occidentalis californicus*), may travel through, winter in or visit Delta aquatic habitats. Delta smelt and Sacramento splittail seek shallow, tidally-influenced, freshwater (< 2 ppt salinity) backwater sloughs and edge waters for spawning. To assure egg hatching and larval viability, spawning areas also must provide suitable water quality (*i.e.*, low concentrations of contaminants) and substrates for egg attachment (*e.g.*, submerged tree roots, branches, emergent vegetation).

Table 3. General Habitats Trend Analysis for CALFED Focus Areas*, historic vs. current estimations. See text for description of estimations.

Habitat Type	Potential Habitat Estimation (acres) (Küchler 1977)	1990 Habitat Estimation (acres) (GAP 1996)	Percentage Difference**
Agriculture	minimal	9,764,504	Not applicable
Alkali Scrub	1,386,185	515,595	-63%
Chaparral	2,755,946	2,749,119	- %
Cismontane Woodlands	10,215,026	11,035,866	+%
Coastal Scrub	340,294	124,075	-64%
Coniferous and Mixed Forests	12,212,249	7,983,387	-%
Grassland	8,930,311	4,327,147	-52%
Riparian	1,192,649	158,944	-87%
Sagebrush	872,070	714,927	-18%
Salt Marsh	156,537	58,356	-63%
Tule Marsh	1,969,013	176,137	-91%
Urban	effectively zero	1,415,279	N/A
Water	156,778	350,116	+123%
Wet Meadow	category not used	57,369	N/A

* Includes the ERP, MSCS, and Watershed Program Focus Areas
**Figures are rounded to nearest whole number.

Habitat Trends

Potential natural vegetation in the Delta included approximately 520,000 acres of tule marsh, covering 72% of the area of the Delta (Küchler 1977). Since the 1850's, the Estuary's tidal

marshes have experienced a cumulative loss of approximately 94 percent (Nichols et al. 1986, Monroe and Kelly 1992). In 1990, the Delta contained 597,624 acres of agricultural land and 49,450 acres of urban land, covering nearly 87% of the area of the Delta (GAP 1996). Tule marshes had been reduced to 8,904 acres, a decline of 98% from the estimate of Küchler (1977). All wetland and open water habitat combined covered only 71,387 acres, covering less than 10% of the Delta (GAP 1996). Most channels in the Delta have been dredged and shallow wetland habitats have been separated from the river by an extensive levee system.

Water flow and salinity in the Delta is strongly influenced by operations of the CVP and SWP including the Tracy Pumping Plant (CVP), the Banks Pumping Plant (DWR), and numerous smaller water diversions. The storage of runoff in reservoirs as well as diversions of fresh water move the mixing zone upstream, reducing habitat quality for Delta fishes. When river flows are low, and pumps are pulling in large amounts of water, the net flow of water is in the upstream direction in the channel, and fish can be entrained at the pumps and killed. In addition to direct mortality, upstream movement of water can delay migration and increase fishes exposure to predation, poor water quality, and other factors.

Several aquatic non-native species have been introduced to the Delta system (see Nichols et al. 1986). These non-natives have out competed many native species, replacing natural populations. For further information on non-native species, see the Cumulative Effects Section of the Chapter on Effects of the Proposed Action .

Delta Smelt

The current environmental baseline for Delta smelt is established by the March 6, 1995, and the February 12, 1993, (Delta smelt and winter-run, respectively) biological opinions on the effects of long-term operation of the CVP and the SWP, the October 13, 1981, Corps export pumping guidance, the November 2, 1994, biological opinion on the Environmental Protection Agency's proposed Water Quality Standards for the San Francisco Bay/Sacramento-San Joaquin Rivers and Delta in conjunction with the 1995 Water Quality Control Plan, and the statutory mandate pursuant to Section 3406(b)2 of the CVP Improvement Act to manage 800 TAF of water for fish and wildlife purposes. Part of this environmental baseline requires Delta outflows between February 1 to June 30 to transport larval and juvenile delta smelt out of the "zone of influence" of the CVP and SWP export pumps and maintain the location of X2 at or downstream of three distinct points: the confluence of the Sacramento and San Joaquin rivers, Chipps Island, and Roe Island. The length of time X2 must be positioned at these set locations in each month is determined by a formula that considers the previous month's inflow to the Delta and a "Level of Development" factor, denoted by a particular year.

Compliance with the salinity criteria at Roe and Chipps islands can be achieved in any one of the following three ways: (1) the daily salinity value meets the requirement, (2) the system is operated on that day so as to meet the "flow equivalent," or (3) by using a 14-day moving average. The use of the 14-day moving average allows the mean location to be achieved despite the varying strength of tidal currents during the lunar cycle because any 14 day period would include the full range of spring and neap tidal conditions. Meeting the confluence standard can be achieved by meeting either implementation scheme 1 or 3 above.

Delta modeling conducted by a variety of individuals and agencies for the March 6, 1995 biological opinion analyzed approximately 73 years of hydrologic data from the Sacramento/San Joaquin Rivers and Delta. The analysis showed the average position of X2 would be either downstream of the targeted compliance point or would meet the compliance point through an increase in the number of days, over and above the minimum required, in many of the years. This compliance point has been maintained mainly because the export facilities have not had the ability to capture all of the unimpaired run-off and, thus, have been well below the Export-Inflow Ratio (E/I Ratio) providing better environmental conditions than the minimum required by existing regulations. Therefore, the Service was able to provide the CVP and SWP with a non-jeopardy biological opinion on the long-term operation of their projects. Additionally, the Service anticipated that the estuarine conditions for delta smelt would be improved by (1) the signing of the Framework Agreement leading to the Bay-Delta Accord that would require the CVP and SWP to make an equitable contribution to meet the revised water quality standards, (2) the obligation of Federal agencies carrying out programs for the conservation (recovery) of listed species as imposed by section 7 of the Act, and (3) the scheduled renewal or reopening of water contracts and licenses that would provide an additional opportunity to implement Recovery Plan objectives. Collectively, these actions would result in phased improvement to water quality-based habitat requirements.

Due to subsequent wet years, the regulatory requirements have been met every year since 1995. The CVP/SWP were able to meet the compliance point for X2. The CVP/SWP, because of favorable hydrologic conditions, did not need to manage the system to the E/I ratio all of the time. If these beneficial environmental parameters are maintained over time, it is likely that the species would be heading toward recovery. However, these benefits are offset by new projects that are being proposed which are described later. Therefore, rather than improving the environmental baseline with these good water years, it has simply been maintained. Table 4 identifies the number of required days X2 was to be at specific compliance locations and the actual number of days X2 was at or downstream of the required location. These data are based on preliminary data provided by the California Department of Water Resources, Operations Division. This analysis is consistent with how the Service evaluated the original project for which it issued the March 6, 1995 biological opinion (Service, 1995).

Adult Delta smelt spawn in central Delta sloughs from February through August in shallow water areas having submersed aquatic plants and other suitable substrates and refugia. These shallow water areas have been identified in the Delta Native Fishes Recovery Plan (Recovery Plan) (Service 1995) as essential to the long-term survival and recovery of Delta smelt and other resident fish. A "no net loss" strategy of Delta smelt population and habitat is proposed in this Recovery Plan.

Delta smelt are adapted to living in the highly productive Estuary where salinity varies spatially and temporally according to tidal cycles and the amount of freshwater inflow. Despite this tremendously variable environment, the historical Estuary probably offered relatively consistent spring transport flows that moved Delta smelt juveniles and larvae downstream to the mixing zone. Since the 1850's, however, the amount and extent of suitable habitat for the Delta smelt has declined dramatically. The advent in 1853 of hydraulic mining in the Sacramento and San Joaquin rivers led to increased siltation and alteration of the circulation patterns of the Estuary (Nichols *et al.* 1986, Monroe and Kelly 1992). The reclamation of Merritt Island for agricultural purposes, in the same year, marked the beginning of the present-day cumulative loss of 94 percent of the Estuary's tidal marshes (Nichols *et al.* 1986, Monroe and Kelly 1992).

In addition to the degradation and loss of estuarine habitat, the delta smelt have been increasingly subject to entrainment, upstream or reverse flows of waters in the Delta and San Joaquin River, and constriction of low salinity habitat to deep-water river channels of the interior Delta (Moyle *et al.* 1992). These adverse conditions are primarily a result of drought and the steadily increasing proportion of river flow being diverted from the Delta by the CVP and the SWP (Monroe and Kelly 1992). There is a correlation between the proportion of Delta smelt that reside in Suisun Bay and overall abundance. This relationship indicates that the summer townet index increased dramatically when outflow was between 34,000 and 48,000 cfs which placed X2 between Chipps and Roe islands. Placement of X2 downstream of the Confluence, Chipps and Roe islands provides Delta smelt with low salinity and protection from entrainment, allowing for productive rearing habitat that increases both smelt abundance and distribution.

TABLE 4. Number of days X2 was required at specific compliance stations and the actual number of days achieved shown by year.

Year	Location	# of required days Starting Feb. 1	# of actual days at*** or downstream
1995	Confluence	150	Essentially all year
	Chips Is.	150	Essentially all year
	Roe Is.	130	138
1996	Confluence	150	249
	Chips Is.	150	161
	Roe Is.	65	126
1997	Confluence	150	225
	Chips Is.	110	124
	Roe Is.	49	52
1998	Confluence	150	Essentially all year
	Chips Is.	150	262
	Roe Is.	115	167
1999	Confluence	150	203
	Chips Is.	143	159
	Roe Is.	51	73
2000	Confluence	150	100**
	Chips Is.	150*	100**
	Roe Is.	57*	60**

* Estimated for 2000

** As of May 10, 2000

*** These are estimated days based on electrical conductivity at Port Chicago, Mallard Slough, and Collinsville

The results of seven surveys conducted by the Interagency Ecological Program (IEP) corroborate the dramatic decline in delta smelt attributable to baseline conditions. Existing operations were meant to provide sufficient Delta outflows from February 1 through June 30 to transport larval and juvenile delta smelt out of the "zone of influence" of the CVP and SWP pumps, and provide them low salinity, productive rearing habitat. This zone of influence has been delineated by Water Resources's Particle Tracking Model and expands or contracts with CVP and SWP combined pumping increases or decreases, respectively (DWR and Reclamation 1993). Tidal action may enhance the hydraulic effects of exports which in turn may effect larvae and juveniles as far west as the Confluence.

According to seven abundance indices which provide information on the status of the delta smelt, this species was consistently at low population levels through the 1980's (Stevens *et al.* 1990). These same indices also showed a pronounced decline from historical levels of abundance (Stevens *et al.* 1990).

Specifically, the summer townet abundance index constitutes one of the more representative indices because the data have been collected over a wide geographic area (from San Pablo Bay upstream through most of the Delta) for the longest period of time (since 1959). The summer townet abundance index measures the abundance and distribution of juvenile delta smelt and provides data on the recruitment potential of the species. Since 1983, (except for 1986, 1993, and 1994), this index has remained at consistently lower levels than previously found. These consistently lower levels correlate with the 1983 to 1992 mean location of X2 upstream of the Confluence, Chipps and Roe islands.

The second longest running survey (since 1967), the fall midwater trawl survey (FMWT), measures the abundance and distribution of late juveniles and adult delta smelt in a large geographic area from San Pablo Bay upstream to Rio Vista on the Sacramento River and Stockton on the San Joaquin River (Stevens *et al.* 1990). The fall midwater trawl indicates the abundance of the adult population just prior to upstream spawning migration. The index that is calculated from the FMWT survey uses numbers of sampled fish multiplied by a factor related to the volume of the area sampled. Until recently, except for 1991, this index has declined irregularly over the past 20 years (CDFG unpublished data, 1999). Since 1983, the Delta smelt population has exhibited more low fall midwater trawl abundance indices, for more consecutive years, than previously recorded. The 1994 FMWT index of 101.7 was a continuation of this trend. This occurred despite the high 1994 summer townet index for reasons unknown. The 1995 summer townet was a low index value of 319 but resulted in a high FMWT index of 898.7 reflecting the benefits of large transport and habitat maintenance flows due to an extremely wet year.

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The FMWT abundance index (128.3) for 1996 represented the fourth lowest on record. For 1997, the abundance index (360.8) almost tripled over last years results. In 1998, the summer townet index was 3.3 and the fall index was 417.6, which was up slightly from the 1997 index. Recovery criteria, including both abundance and distribution criteria based on numbers derived from the FMWT, have not been met to date. This limited data indicates that Delta smelt may not be moving toward recovery.

The Service issued a non-jeopardy biological opinion (1-1-95-F-110) for the Delta Wetlands Project after significant negotiations and changes to the proposed project description. The original project description significantly degraded the estuarine conditions by adversely affecting Delta hydrology and causing incremental up-stream shifts of X2. The Delta Wetlands Project, as modified, includes conditions to minimize up-stream shifts of X2 and adverse effects to Delta hydrology within the action area. The Service issued a draft jeopardy biological opinion for the Interim South Delta Program as the original project significantly degraded the estuarine conditions by adversely affecting Delta hydrology and causing incremental up-stream shifts of X2. The Service has also issued a biological opinion for the issuance of a water contract to the County of Sacramento for 35,000 af of water to be diverted from the American River. The opinion for Sacramento County evaluated a phased approach to delivery of new water with very small increments of water to be delivered for the first few years and that the larger amount would be fully evaluated in the context of a broader section 7 consultation when OCAP is reinitiated at the long-term contract renewal phase of CVPIA. Additionally, the Service just completed a consultation with Reclamation concerning additional supplies to Contra Costa Water District (CCWD) under their existing contracts consistent with CCWD's Future Water Supply Program. The outcome of this opinion specifically states that additional supplies over and above those which were authorized in the original biological opinions for the Los Vaqueros Project would not be authorized until a new biological opinion on OCAP was completed or Reclamation reinitiated consultation.

Regarding the operation of the existing consultation for the Los Vaqueros Project, during May and June of 1999, over 100,000 Delta smelt were incidentally taken at the State and Federal export facilities. However, none were found to have entered CCWD's intake at Old River during this same period. Pursuant to the operations plan in the Los Vaqueros biological opinion, there were no diversions during two weeks of the period in question; however, when diversions resumed, no smelt were found to pass through the screen in the monitoring program.

Delta smelt remained in the Delta for an extended period of time during the spring of 1999. It was hypothesized that it was a result of cooler water temperatures. The final summer townet index for 1999 is 11.9, an increase from the 1998 index of 3.3. However, this is still below the pre-decline

average of 20.4 (1959-1981, no sampling 66-68). The FMWT index for 1999 is 864 which is a moderate level.

Other projects, which have not under gone section 7 consultation, have been proposed and include East Bay Municipal Utility District amended contract renewal, development of a long-term contract with El Dorado County Water Agency, numerous Warren Act contracts, funding or facilitation of infrastructure improvements that will allow for additional withdrawals from CVP supplies with CVP facilities, or through other mechanisms. These projects likely would result in a deterioration of the environmental baseline, causing X2 to incrementally move up-stream if these projects proceed as proposed. Degradation of the environmental baseline may significantly affect recovery and survival of Delta smelt

Sacramento Splittail

The decline in splittail abundance has taken place during a period of increased human-induced changes to the seasonal hydrology of the Delta, especially the increased exports of freshwater from the Delta and increased diversions of water to storage. These changes include alterations in the temporal, spatial, and relative ratios of water diverted from the system. These hydrological effects, coupled with severe drought years, introduced, non-native aquatic species, the loss of shallow-water habitat to reclamation activities, and other human-caused actions, have reduced the splittail's capacity to recover from natural seasonal fluctuations in hydrology for which it was adapted.

Analyses of survey data collected from 1967 to 1993 (Meng 1993, Meng and Moyle 1995), further analyses by the Service using data from 1967 through 1997 (Service, 1999), CDFG, University of California at Davis, and biologists from several different studies reveals the following trends:

(1) Overall, splittail abundance indices have declined. Meng and Moyle (1995) demonstrated that on average, splittail have declined in abundance by 60 percent through 1993. These data were updated by the CDFG to include the most current data available. The Service conducted the statistical analysis using the updated information. The results were similar. These updated data demonstrate that on average, splittail have declined significantly in abundance by 50 percent since 1984. The greatest declines (over 80 percent) were found from studies that sampled the shallow Suisun Bay area, the center of the range of the species (Meng and Moyle 1995). The updated information also shows a significant decline (43 percent) for the studies that sampled the shallow Suisun Bay area. The Bay study that began in 1980 in the lower Estuary, at the outermost edge of splittail range, showed the least percent decline (20 percent) (CDFG, unpublished data) through

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1993. The Bay study analysis completed on the updated data also showed the smallest decline for study (6 percent). The number of splittail young taken at State and Federal pumping facilities (per acre-foot of water pumped), as of 1993, had declined 64 percent since 1984. With the updated data, the number of splittail young taken at State and Federal pumping facilities demonstrated a 97 percent increase. This percent increase is due to the unusually high salvage that occurred during 1995.

Splittail populations are estimated to be 35 to 60 percent of what they were in the 1940's, and these estimates may be conservative (Moyle in prep). Department midwater trawl data indicate a decline from the mid-1960s to the late 1970s, followed by a resurgence, with yearly fluctuations, through the mid-1980s. From the mid-1980s through 1994, splittail numbers have declined in the Delta, with some small increases in various years. This decline is also demonstrated in the updated Department data.

(2) Overall splittail abundances vary widely between years. Sommer *et al.* 1997 also found that splittail recruitment success fluctuates widely from year to year and over long periods of time. During dry years abundance is typically low. During the dry years of 1980, 1984, 1987, and 1988 through 1992, splittail abundance indices for young-of-the-year were low, indicating poor spawning success. Additionally, all year class abundances were low during these years. In 1994, the fourth driest year on record, all splittail indices were extremely low.

Wet years are assumed to provide essential habitat for splittail and allow populations to rebound from dry years. Successful reproduction in splittail is often highly correlated with wet years. Large pulses of young fish were observed in wet years 1982, 1983, 1986, and 1995. In 1995, one of the wettest years in recent history, an increase in all indices was recorded, as in 1986, which was another wet year following a dry year. However, young of the year taken per unit effort (for example, either the number of fish per net that is towed or the number of fish per volume of water sampled) has actually declined in wet years, from a high of 12.3 in 1978 to 0.3 in 1993. The updated data from CDFG demonstrate this same decline in wet years, from 37.3 in 1978 to 0.6 in 1993. The abundance indices of splittail during the years of 1995, 1996, and 1997 were 44.5, 2.1, and 2.6, respectively. In 1995, a very wet year, splittail abundances were high. However in 1996 and 1997, both wet years, abundance indices were low. A large splittail year class was produced in 1998, a wet year. However, overall splittail declines remain high (82 percent/43 percent with updated data) in the shallow-water Suisun Bay area, the center of its distribution..

(3) A strong relationship exists between young-of-the-year abundance and outflow (i.e., river outflow into San Francisco Bay after water exports are removed). As outflow increases, annual abundance of young-of-the-year splittail increases. Changes in outflow account for 55 to 72

percent of the changes seen in young-of-the-year splittail abundance, depending on which survey data are analyzed.

(4) Splittail are most abundant in shallow areas of Suisun and Grizzly bays where they generally prefer low-salinity habitats. Salinities in Suisun and Grizzly bays increase when, as a result of water exports or drought conditions, the mixing zone (the freshwater-saltwater interface) shifts upstream.

(5) Concentration of splittail in shallow areas suggests that they are particularly vulnerable to reclamation activities, such as dredging, diking, and filling of wetlands. The above data indicate that splittail abundances vary widely in response to environmental conditions, but the general population numbers are declining.

Changes in water diversions are most likely at the SWP. For the most part, the Federal pumping plant has operated at capacity for many years (pumping at rates up to 4,600 cfs), so increased exports at this plant are unlikely. However, the SWP pumping plant and the State Aqueduct have considerable unused capacity. The SWP currently pumps at rates up to 6,400 cfs and plans to increase pumping rates by more than 50 percent. Local private water diversions are relatively stable and export up to 5,000 cfs from about 1,800 diversions scattered throughout the Delta. The DWR (1992) reported past and projected SWP deliveries from Delta sources during the years of 1962 to 2035. In the 1980's, deliveries ranged from 1.5 MAF to 2.8 MAF. By 2010, deliveries of up to 4.2 MAF are planned.

If the exceedingly high take (millions of fish) at the export facilities that occurred in 1995 continues to occur in other wet years, the species may be precluded from recovery. In a good year such as 1995, splittail spawn in prolific numbers. These good years are needed to maintain the population of splittail in the Delta. However, the high take that occurs during these years, offsets the benefits that a strong year class may provide.

Those projects discussed in the Delta Smelt Environmental Baseline section have also under gone section 7 consultation for their effects to splittail (Note: the splittail listing is currently under litigation). Additional future deliveries made south of the Delta through SWP or CVP facilities, additional supplies provided to contractors or new water supply contracts that effect carryover storage in reservoirs, facilities that are developed to divert additional instream flows, or other water development projects that result in losses of instream flows, greater entrainment of splittail, or reduce the areal extent of floodplain inundation for splittail spawning will degrade the environmental baseline for splittail such an extent that it may preclude recovery for the splittail.

Salt Marsh

Habitat Description and Associated Species

The San Francisco Bay complex, including San Pablo Bay and Suisun Bay and Marsh, is the largest estuarine ecosystem in California. Tidal marshes consist of a low marsh dominated by California cordgrass (*Spartina foliosa*) or tules (*Scirpus* spp.), a middle marsh of pickleweed (*Salicornia virginica*), alkali bulrush (*Scirpus robustus*), or cattails (*Typha* spp.), and a high marsh of peripheral halophytes (plants which grow in salty soils) with infrequent tidal coverage. Federally listed species associated with salt marsh habitats include: bald eagle (*Haliaeetus leucocephalus*), California brown pelican (*Pelecanus occidentalis*), California clapper rail (*Rallus longirostris obsoletus*), California least tern (*Sterna antillarum browni*), and salt marsh harvest mouse (*Reithrodontomys raviventris*). Listed plants include soft bird's-beak (*Cordylanthus mollis* ssp. *mollis*), California seablite (extirpated) (*Suaeda californica*), marsh sandwort (*Arenaria paludicola*), and Suisun thistle (*Cirsium hydrophilium* var. *hydrophilium*).

Habitat Trends

Originally, the San Francisco Bay complex included an estimated 181,446 acres of tidal marsh, including 46,405 acres in San Francisco Bay, 63,678 acres in San Pablo Bay, and 71,363 acres in Suisun Bay and Marsh (Service 1984). Küchler (1977) estimated that potential natural vegetation of salt marsh for the CALFED Focus Areas to be 156,537 acres with the San Francisco Bay complex having 96,583 acres of salt marsh; these figures omit the brackish marshes in the Suisun Bay area, which are categorized as tule marsh in Küchler's map.

In 1990, salt marsh and brackish marsh were estimated to cover 69,291 acres, including 54,088 acres in the Sacramento Basin (Suisun Bay and Marsh), 9,443 acres in the Delta, and 4,760 acres in the San Francisco Bay area (GAP 1996). This estimate probably includes large areas of diked marsh, particularly in Suisun Bay where non-tidal diked marshes are managed primarily for waterfowl. Dedrick (1993) estimated that about 30,100 acres of tidal marsh currently remain, representing 17 percent of historical marsh. Some salt marshes have been backfilled, eliminating the high marsh zones and adjacent upland habitat, others are narrow strips bordering dikes. Existing tidal marshes are fragments of the original marshes, and only a few large marshes remain.

Riverine, Riparian, and Floodplain

Habitat Description and Associated Species

Riparian forests of the Central Valley are dominated by Fremont cottonwood (*Populus fremontii* ssp. *fremontii*) and willow (*Salix* spp.) near the rivers, with western sycamore (*Platanus racemosa*), California box elder (*Acer negundo* var. *californicum*), and valley oak (*Quercus lobata*) dominating the less frequently flooded higher terraces. Floodplain habitats above the riparian zone typically do not support wetland vegetation, but are hydrologically linked to rivers and riparian forests by periodic flooding and can be considered with them as an ecological unit. Streams historically flooded during the winter rainy season sometimes dry up partially or completely during summer droughts. Several fish species migrate from ocean or estuary habitats to spawn in sloughs, tributary streams, or inundated floodplains throughout the Central Valley. Loss of appropriate spawning substrate has contributed to the decline of several fish species. Sacramento splittail, which migrate upstream to spawn in flooded riparian and floodplain vegetation, have also declined. The endangered shortnosed sucker (*Chasmistes brevirostris*) and Shasta crayfish (*Pacifastacus fortis*) are found in mountain and foothill streams.

The federally threatened Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) occurs in riparian habitats of the Sacramento Valley, Sierra foothills, some Delta levees and tributaries, and the San Joaquin Valley and has declined with loss of habitat. Federally endangered least Bell's vireos (*Vireo belli pusillus*) have not nested anywhere in the Central Valley for several decades, and endangered southwestern willow flycatchers (*Empidonax traillii extimus*) are restricted to the South Fork of the Kern River near Lake Isabella. The federally endangered riparian woodrat (San Joaquin Valley woodrat) (*Neotoma fuscipes riparia*) and riparian brush rabbit (*Sylvilagus bachmani riparius*) are now largely or completely restricted to Caswell State Park on the Stanislaus River, which is the largest remaining tract of riparian forest in the northern San Joaquin Valley. The federally threatened California red-legged frog (*Rana aurora draytoni*) has now been extirpated from 75% of its historic range, mostly in the Central Valley. The endangered California freshwater shrimp inhabits slow-moving freshwater streams in Marin, Sonoma, and Napa counties.

The endangered bald eagle is found along rivers and riparian habitats and is increasing in numbers throughout portions of its range. The Federal candidate species McCloud River redband trout (*Oncorhynchus mykiss* ssp.) and California tiger salamander (*Ambystoma californiense*) are also found in portions of this habitat. Federally listed plant species include Chinese Camp Brodiaea (*Brodiaea pallida*), found along serpentine streams, red hills vervain (*Verbena californica*), Contra Costa wallflower (*Erysimum capitatum* ssp. *angustatum),* Antioch Dunes evening-primrose

(*Oenothera deltoides* ssp. howellii), and Pitkin marsh lily (*Lilium pardalinum* ssp. *pitkinense*), which may be found along streams in oak habitats. The yellow-billed cuckoo (*Coccyzus americanus*) has been petitioned for listing under the ESA.

Habitat Trends

Potential natural vegetation within the CALFED Program Focus Areas includes an estimated 1,192,649 acres of riparian habitat, including 837,147 acres in the Sacramento Basin, 288,551 acres in the San Joaquin Basin, 48,123 acres in the Tulare Basin, and 18,828 acres in the Delta (Küchler 1977). Historical acreages of riparian forest have been independently estimated at 1,600,000-2,000,000 acres in the Central Valley (Warner and Hendrix 1985) and 902,000 acres in the San Joaquin and Tulare Basins (San Joaquin Valley Drainage Program 1990, adapted from Hall 1886 and Küchler 1977).

In 1990, riparian habitat within the CALFED Program Focus Areas covered an estimated 159,792 acres (GAP 1996), representing a reduction of 87% from the potential natural vegetation described in Küchler (1977). Regional reductions in riparian habitat were 92% in the Sacramento Basin, 91% in the San Joaquin Basin, 24% in the Tulare Basin, and 86% in the Delta. An estimated 2% of the historical riparian habitat remains on the Sacramento River (McGill 1979, McCarten and Patterson 1987). As a result, riparian-dependent species include several of the most critically endangered species in the Central Valley.

Freshwater Wetlands

Habitat Description and Associated Species

Freshwater wetlands are characterized by a specialized community of aquatic dependent plant species such as the common tule (*Scirpus acutus* var. *occidentalis*), broadleaf cattail (*Typha latifolia*), sedges (*Carex* spp.), spike-rush (*Eleocharis* spp.) and rushes (*Juncus* spp.). Wetlands are usually defined by the types of plants, types of soils, and inundation duration. Wetland types in this category include deep and shallow freshwater marshes, wet meadows, seasonal wetlands, saturated freshwater flat, and vegetated shallows.

Federally listed species associated with freshwater wetlands are: Aleutian Canada goose (*Branta canadensis leucopareia*), bald eagle (*Haliaeetus leucocephalus*), the proposed Buena Vista Lake shrew (*Sorex ornatus relictus*), California red-legged frog, marsh sandwort (*Arenaria paludicola*), giant garter snake (*Thamnophis gigas*), and San Francisco garter snake (*T. sirtalis*

tetrataenia). The California tiger salamander (*Ambystoma californiense*), a Federal candidate species, breeds in freshwater wetlands.

The bald eagle occurs widely throughout the study area. After severe declines due largely to pesticides such as DDT, its numbers have been increasing following new pesticide regulations. Ecosystem degradation in the Central Valley may limit the extent of their recovery in the Central Valley. Eagles use riparian and wetland habitats for resting and foraging. Recovery of bald eagles may be limited by availability of nest trees in riparian and woodland habitat and by declining wetland habitat. California red-legged frogs have been virtually extirpated from the floor of the Central Valley, despite their historic presence in the Central Valley in numbers large enough for commercial harvest. They currently remain only in foothills of the Coast Range and isolated drainages in the Sierra Nevada. The giant garter snake occurs in scattered populations from Butte County south to the central San Joaquin Valley. The Aleutian Canada goose winters in restricted areas of the Sacramento and San Joaquin Valleys. The Buena Vista Lake shrew is restricted to remnant wetland areas near the Kern Lake Preserve and Kern National Wildlife Refuge. The San Francisco garter snake has been reduced to 5 populations that are unprotected, unstable, or declining. Marsh sandwort populations in San Francisco and Santa Cruz Counties have been extirpated by urban development.

Wet meadows may provide habitat for the Kneeland Prairie penny-cress (*Thlaspi montanum* var. *californicum*), water howellia (*Howellia aquatilis*), and Hickman's cinquefoil (*Potentilla hickmanii*).

Habitat Trends

Potential natural vegetation within the CALFED Program Focus Areas included an estimated 1,969,013 acres of tule marshes (Küchler 1977). Independent estimates of historic wetland acreages range from 1,500,000 acres (Warner and Hendrix 1985, cited in San Joaquin Valley Drainage Program 1990) to 4,000,000 acres in the Central Valley (Service 1978), and 1,093,000 acres in the San Joaquin and Tulare Basins (San Joaquin Valley Drainage Program 1990, adapted from Hall 1886 and Küchler 1977).

Freshwater emergent wetlands occupied about 554,000 acres of the Central Valley in the 1940s (Frayer et al. 1989, Central Valley Habitat Joint Venture 1990). By 1990, only 176,137 acres remained (GAP 1996), representing a reduction of 91% from the potential natural vegetation described by Küchler (1977). Regional reductions in freshwater emergent wetlands were estimated at 91 % in the Sacramento Basin, 92 % in the San Joaquin Basin, 92% in the Tulare Basin, 93% in the Delta, and 91% in the San Francisco Bay area.

The hydrology of many of the remaining wetlands has been altered from seasonal to permanent inundation. This change has altered plant communities and facilitated the invasion of introduced aquatic predators such as bullfrogs, bass, and sunfish. These species compete with or prey upon several listed species, including California red-legged frogs and giant garter snakes.

Vernal Pools

Habitat Description and Associated Species

Vernal pools are seasonal wetlands that are unique to the Mediterranean climate region of California and northwestern Baja California and are most abundant in California's Central Valley. Many of the endangered plants and invertebrates that inhabit vernal pools have sporadic and disjunct distributions (i.e., they occur in relatively few pools at a given location and some of these locations are widely separated from each other).

Vernal pools are distinguished by their hydrology and their relationship to adjacent habitat. First, the Mediterranean climate of the region results in most rain falling during the winter. On locally flat land the water tends to pool after each rainfall in small depressions on the land surface. Over time the soils where the wetting and drying continue year after year develop a layer below the surface that becomes resistant to water. In some soils a hardpan of mostly lime develops. In others there is a layer where clay particles have built up. The pools gather water that falls as rain over a small area of relatively flat land and then hold it at the surface until it evaporates during the summer, providing a unique habitat type. Most of these vernal pools are found on sites where the soil has been in place for thousands of years. Over thousands of years a group of species has developed adaptations to the annual wetting and drying cycle and the mineral content of the water in the pools. Other species near pools (particularly co-adapted pollinators) interact with the plants and animals found in the pools themselves. The area comprising the pools, the areas of catchment where the water gathers as rain falls, and the associated species found in the habitat near the pools form a unit that is referred to as a "vernal pool complex". Conservation of vernal pool species depends on maintaining the ecosystem functions of the entire complex.

Federally listed plant species associated with vernal pools include Butte County meadowfoam (*Limnanthes floccosa* ssp. *californica*), Sebastopol meadowfoam (*L. vinculans*), Calistoga allocarya (*Plagiobothrys strictus*), Napa bluegrass (*Poa napensis*), Sonoma alopecurus (*Alopecurus aequalis* ssp. *sonomensis*), Colusa grass (*Neostapfia colusana*), Contra Costa goldfields (*Lasthenia conjugens*), Sonoma sunshine (*Blennosperma bakeri*), few-flowered navarretia (*Navarretia leucocephala* ssp. *pauciflora*), Lake County stonecrop (*Parvisedum leiocarpum*), many-flowered navarretia (*N. l.* ssp. *plieantha*), succulent owl's-clover (*Castilleja*

campestris ssp. *succulenta)*, Greene's tuctoria (*Tuctoria greenei*), Crampton's tuctoria or Solano grass (*T. mucronata*), hairy Orcutt grass (*Orcuttia pilosa*), Sacramento Orcutt grass (*O. viscida*), San Joaquin Valley Orcutt grass (*O. inaequalis*), slender Orcutt grass (*O. tenuis*), Hoover's spurge (*Chamaesyce hooveri*), and Loch Lomond button-celery (*Eryngium constancei*). White sedge (*Carex alba*), Burke's goldfields (*Lasthenia burkei*), and Kenwood marsh checker-mallow (*Sidalcea oregana* ssp. *valida*) may also be found associated with vernal pool complexes. Most of these species are patchily distributed within the Sacramento and/or San Joaquin Valleys in vernal pool complexes. Calistoga allocarya, few-flowered navarretia, and Loch Lomond button celery are restricted to Napa County. Conservancy fairy shrimp (*Branchinecta conservatio*), longhorn fairy shrimp (*B. longiantenna*), vernal pool fairy shrimp (*B. lynchi*), delta green ground beetle (*Elaphrus viridis*), California red-legged frogs, and vernal pool tadpole shrimp (*Lepidurus packardi*) are federally listed animal species found in vernal pool habitats. The Federal candidate species California tiger salamander also breeds in vernal pools.

Habitat Trends

Holland (1998) mapped the distribution of vernal pool complexes in the Central Valley. Vernal pools are scattered throughout the grassland habitats mapped by Küchler (1977) and GAP (1996) but occur at too fine a resolution to have been adequately mapped as a distinct habitat type by those studies. Holland (1978) estimated that vernal pools occurred historically at varying densities over an estimated 31 percent (4.15 million acres) of the Central Valley, and the Service estimates that 60-85% of historical vernal pool habitat had been eliminated as of 1973 (59 **FR** 48136).

Inland Dune

Habitat Description and Associated Species

The Antioch Dunes are Pleistocene, wind-deposited sands adjacent to the San Joaquin River east of the City of Antioch in Contra Costa County. Exploitation of the dunes dates back to 1885, with the establishment of a pottery works. Subsequent activities that eliminated and degraded habitat included sand mining, agricultural conversion of sandy soils adjacent to the dunes, industrialization, urban expansion, power line right-of-way and fire break maintenance, and off-road vehicle recreation. Large numbers of black locust and other weedy, non-native plants have invaded the disturbed dunes, displacing endemic species from much of their habitat. Special-status species associated with Antioch Dunes are Contra Costa wallflower, Antioch Dunes evening-primrose, and Lange's metalmark butterfly.

Habitat Trends

For the Antioch Dunes, a 1908 U.S. Geological Survey map shows approximately 190 acres of dune deposits along approximately 2 miles of river front, averaging about 0.17 mile in width (U.S. Fish and Wildlife Service 1984, Howard and Arnold 1980). Today, approximately 70 acres of the original habitat remain, but most is severely degraded and lacks natural dune topography. Since 1980, the Service has owned and managed 60 acres of habitat and buffer as a satellite to the San Francisco Bay National Wildlife Refuge Complex and has negotiated agreements with adjacent landowners (including the Pacific Gas and Electric Company) to protect an additional 20 acres (U.S. Fish and Wildlife Service 1984, Howard and Arnold 1980). The Service has removed the locust trees within the refuge boundary and is actively restoring the dunes.

Interior Grasslands

Habitat Description and Associated Species

Grasslands in the Central Valley were originally dominated by native perennial grasses such as purple needlegrass or tussockgrass (*Nassella pulchra*) and alkali sacaton (*Sporobolus airoides*). Currently, most grasslands in the Central Valley are dominated by introduced annual grasses of Mediterranean origin and a mixture of native and introduced forbs. Please refer to the San Joaquin Valley Native Species Recovery Plan (Service 1998) for a complete description of this habitat and list of common and scientific names of plants and animals.

Federally endangered or threatened blunt-nosed leopard lizards (*Gambelia sila*), San Joaquin kit foxes (*Vulpes macrotis mutica*), giant kangaroo rats (*Dipodomys ingens*), Tipton kangaroo rats (*D. nitratoides nitratoides*), and Fresno kangaroo rats (*D. n. exilis*) occur in arid grasslands in the San Joaquin and Tulare Basins. Grasslands are used by the federally listed Aleutian Canada goose and the proposed mountain plover (*Charadrius maontanus*) for wintering areas. The threatened Alameda whipsnake (*Masticophis lateralis euryxanthus*) is found in grasslands adjacent to chaparral and scrub in Alameda and Contra Costa Counties. The Kern primrose sphinx moth (*Euproserpinus euterpe*) occurs locally in agricultural fields and grasslands in the Walker Basin in Kern County. Reintroduced California Condors (*Gymnogyps californianus*)(in the southern San Joaquin Valley) range widely and may forage in grassland habitat. Federally endangered or threatened plants, such as Bakersfield cactus (*Opuntia treleasei*), California jewelflower (*Caulanthus californicus*), Hartweg's golden sunburst (*Pseudobahia bahiifolia*), San Joaquin adobe sunburst (*P. peirsonii*), Ben Lomond wallflower (*Erysimum teretifolium*), Keck's checkerbloom (*Sidalcea keckii*), and San Joaquin wooly-threads (*Lembertia congdonii*) occur in isolated populations within grassland habitat in the San Joaquin and Tulare Basins. Other listed

plants include Clara Hunt's milkvetch (*Astragalus clarianus*) and Tiburon mariposa lily (*Calochortus tiburensis*) (in serpentine grasslands). The endangered San Joaquin adobe sunburst (*Pseudobahia personii*) is restricted to grasslands on adobe clay soils in the San Joaquin Valley. The large-flowered fiddleneck (*Amsinckia grandiflora*) occurs in grasslands on a few sites in Alameda, San Joaquin, and Contra Costa Counties. Showy Indian clover (*Trifolium amoenum*) originally occurred in grasslands from Mendocino to Santa Clara Counties, but is now extirpated from all but one site in Sonoma County.

Habitat Trends

Less than 1% of remaining grassland areas in the Central Valley contain enough native grass species to be labeled either valley sacaton or valley needlegrass grasslands (GAP 1996).

Alkali Desert Scrub

Habitat Description and Associated Species

Alkali desert scrub is dominated by low succulent chenopod shrubs including iodine bush (*Allenrolfea* sp.), saltbush (*Atriplex* spp.) and seepweed (*Suaeda* spp.). This habitat occurs most commonly on fine-textured, alkaline, or saline soils in areas of impeded drainage. Please refer to the San Joaquin Valley Native Species Recovery Plan (Service 1998) for a complete description of this habitat and list of associated plant and animal species.

Federally endangered or threatened blunt-nosed leopard lizards, San Joaquin kit foxes, giant kangaroo rats, and Fresno kangaroo rats occur in arid grasslands in the San Joaquin and Tulare Basins. Reintroduced California condors, a federally listed species, (in the southern San Joaquin Valley) range widely and may occur in alkali desert scrub habitat. Bakersfield cactus, Hoover's wooly-star, Kern mallow (*Eremalche kernensis*), palmate-bracted bird's- beak, and San Joaquin wooly-threads occur in isolated populations within alkali desert scrub habitat in the San Joaquin and Tulare Basins.

Habitat Trends

Regional declines in alkali scrub habitat range between 63 and 90 percent. Much of the remaining alkali scrub that is suitable habitat for wildlife exists in small, fragmented, and widely distributed patches in the San Joaquin and Tulare Basins. The Küchler mapping designation of San Joaquin saltbush was used to represent the alkali scrub portion of the CALFED Focus Areas and totals

1,386,185 acres (Küchler 1977). By 1990, the potential natural vegetation of alkali scrub was reduced to 515,595 acres or a 63% reduction.

Oak Woodlands

Habitat Description and Associated Species

Several different types of oak woodlands occur in the Central Valley and central coast regions of California. Oak woodlands in the CALFED Program Focus Areas include stands dominated by: valley oak (*Quercus lobata*), mostly along rivers and streams on the valley floor and lower foothills; blue oak (*Q. douglasii*) and gray or digger pine (*Pinus sabiniana*), at low to middle elevations in foothills of the Sierra Nevada and Coast Ranges); coast live oak woodland (*Q. agrifolia*) in valleys and hills of the Coast Ranges; canyon live oak (*Q. chrysolepis*) and interior live oak (*Q. wislizenii*), near some CVP reservoirs; and Oregon white oak (*Q. garryana*) in and near service areas between Redding and Red Bluff. Transitional communities of mixed oaks, other hardwoods, pine, and chaparral occur among many of these woodland types (Forest and Rangelands Assessment Program 1988, Griffin 1977). These oak woodlands correspond to the valley oak savanna, Oregon oak forest, mixed hardwood forest, and blue oak-digger pine forest mapped by Küchler (1977), and can be considered to comprise a "cismontane woodland" category.

Federally listed species associated with oak woodland include: bald eagle, California condor, and California red-legged frog. Reintroduced California Condors (in the southern San Joaquin Valley) range widely and may occur in oak woodland habitat. California red-legged frogs occur in oak woodland in foothills of the Coast Range and isolated drainages in the Sierra Nevada. The candidate California tiger salamander occurs in oak woodland at the fringes of the Central Valley and in the Coast Ranges. The frogs and salamanders live in burrows in these woodlands during dry parts of the year. Suitable habitat for these burrows is essential to their survival. El Dorado bedstraw (*Gallium californicum* ssp. *sierrae*), California jewelflower (*Caulanthus californicus*), Mariposa pussy-paws (*Calyptridium pulchellum*), and San Mateo woolly sunflower (*Eriophyllum latilobum*) may be found in oak/chaparral habitats and Layne's ragwort (*Senecio laynei*) may be found in serpentine oak woodlands.

Habitat Trends

Potential natural vegetation within the CALFED Program Focus Areas included an estimated 10,199,652 acres of cismontane woodland habitat. In the 1940s, woodland dominated by oaks and other hardwoods covered approximately 2,970,000 acres in the Sacramento Basin, 1,720,000

acres in the San Joaquin Basin, and 950,000 acres in the Tulare Basin (Weislander 1945). In 1990, cismontane woodland habitat within the CALFED Program Focus Areas was estimated at 8,424,391 acres (GAP 1996), representing a 17% decline from potential natural vegetation (Küchler 1977).

Evergreen Hardwood and Coniferous Forests

Habitat Description and Associated Species

Coniferous and evergreen hardwood forests generally occur at higher elevations in the Sierra Nevada and Coast Ranges, on the margins of the Central Valley. This category comprises several forest types. Moist coastal forests in San Mateo and Santa Cruz Counties are dominated by redwood *(Sequoia sempervirens)* and Douglas-fir (*Pseudotsuga menziesii*). Montane forests in the Coast Ranges and Sierra Nevada are dominated by a variety of conifers including ponderosa pine (*Pinus ponderosa*), Jeffrey pine (*P. jeffreyi*), Douglas-fir (*Pseudotsuga menziesii*), California red fir (*Abies magnifica*), and white fir (*A. concolor*). In the Coast Ranges, forest stands may be dominated by evergreen hardwoods such as Pacific madrone (*Arbutus menziesii*), tan oak (*Lithocarpus densiflorus*), and California laurel (*Umbellularia californica*). Dry regions support woodlands and savannas dominated by pinyon pine (*P. monophylla*) and California juniper (*Juniperus californica*). On drier sites, stands may be dominated by cypress (*Cupressus* spp.) and fire-dependent species such as Monterey pine *(P. radiata*) and knobcone pine (*P. attenuata*).

Federally listed species associated with coniferous and evergreen hardwood forests are California condor, bald eagle, marbled murrelet (*Brachyramphus marmoratus*), and northern spotted owl (*Strix occidentalis caurina*). The California condor and bald eagle may occur over wide areas and are not specifically limited to coniferous forest. The Sierra Nevada bighorn sheep (*Ovis canadensis californiana*) may be found at higher elevations. The northern spotted owl and marbled murrelet require large tracts of old-growth coniferous forest as nesting habitat and are threatened by conversion to short-rotation forestry practices. Northern spotted owls occur in forests along the western and northern edges of the Sacramento Valley, and marbled murrelets can occur in Santa Cruz and San Mateo Counties. Other species which may be affected include the California spotted owl (*Strix occidentalis)*, Yosemite toad (*Bufo canorus*), and mountain yellow-legged frog (*Rana muscosa*), which were recently petitioned for listing.

Habitat Trends

Potential natural vegetation within the CALFED Program Focus Areas included an estimated 12,212,249 acres of coniferous and mixed forest habitat (Küchler 1977). In the 1940s, coniferous forest covered approximately 3,507,000 acres in the Sacramento Basin, 877,000 acres in the San Joaquin Basin, and 414,000 acres in the Tulare Basin (Weislander 1945). In 1990, coniferous and mixed forest habitat within the CALFED Program Focus Areas was estimated at 10,594,862 acres (GAP 1996), representing a 13% decline from potential natural vegetation (Küchler 1977). Hidden within these totals is a shift from commercially valuable redwood and Douglas fir to juniper and other less merchantable conifers. This shift has contributed to declines of species that need habitat with large trees.

Chaparral

Habitat Description and Associated Species

Chaparral habitats in the Coast Ranges are characterized by dense thickets of common chamise (*Adenostoma fasciculatum*), manzanita (*Arctostaphylos* spp.), ceanothus (*Ceanothus* spp.), scrub oak (*Quercus berberidifolia*), and other shrubs. Chaparral occurs mostly on steep slopes and ridge tops that have thin soils and are hot and dry during the summer. Moister variants of chaparral habitat occur in gullies and on cooler, north-facing slopes (Hanes 1977). The Alameda whipsnake, Presidio clarkia (*Clarkia franciscana)*, Presidio or Raven's manzanita (*Arctostaphylos hookeri* spp. *ravenii*), and pallid manzanita (*A. pallida*) are found in chaparral habitats in Alameda, Contra Costa, and San Francisco counties. Other areas may contain Stebbin's morning glory (*Calystegia stebbinsii*), El Dorado bedstraw, white-rayed pentachaeta (*Pentachaeta bellidiflora*), San Benito evening-primrose (*Camissonia benitensis*), and showy Indian clover.

Patches of serpentine, volcanic, and granitic soils occur sporadically along the western flanks of the Sierra Nevada. Listed species associated with this soils are: Chinese Camp brodiaea, Mariposa pussypaws (*Calyptridium pulchellum*), Santa Clara Valley dudleya (*Dudleya setchellii*), Metcalf Canyon jewelflower (*Streptanthus albidus* ssp. *albidus*), San Mateo thornmint (*Acanthomintha duttonii*), fountain thistle (*Cirsium fontinale* var. *fontinale*), Red Hills vervain (*Verbena californicum*), Layne's ragwort, Tiburon jewelflower (*Streptanthus niger*), Presidio clarkia (*Clarkia franciscana*), and Springville clarkia (*C. springvillensis*).

El Dorado County gabbro soils support the following listed chaparral species: Stebbins' morning-glory, Pine Hill ceanothus (*Ceanothus roderickii*), Pine Hill flannelbush *(Fremontodendron californicum* ssp. *decumbens*), El Dorado bedstraw, and Layne's butterweed. The five El Dorado

County plant species occur primarily in the Pine Hill intrusive complex, a unique and localized geologic formation composed of gabbroic rocks. The Pine Hill intrusion occupies approximately 25,700 acres, and serpentine soils occupy an additional 10,000-15,000 acres in western El Dorado County. These species have a scattered distribution within chaparral and oak woodland Hill intrusion. Both gabbro and serpentine soils strongly influence plant distributions because of nutrient imbalances and other characteristics that favor the growth of plants specifically adapted to these conditions (59 FR 18774; Kruckeberg 1984).

Outcrops of the Ione Formation are primarily restricted to an area of about 35 square miles in Amador County. These outcrops form barren, gravelly, kaolinic soils that are inhospitable for most plants. Kaolin clays are relatively poor at holding several important plant nutrients. The Ione buckwheat (*Eriogonum apricum* var. *apricum*), Irish Hill buckwheat (*E. a.* var. *prostratum*), and Ione manzanita (*A. myrtifolia*) grow in openings within chaparral vegetation on lateritic soils crusts (cement-like crusts of yellow iron oxide) developed under a subtropical or tropical climate during the Eocene. Ione soils exhibit soil properties typical of those produced under tropical climates such as high acidity, high aluminum content, and low fertility (Singer 1978). These soils and the sedimentary deposits with which they are associated also contain large amounts of commercially valuable minerals including quartz sands, kaolinitic clays, lignite (low-grade coal), and possible gold-bearing gravels (Chapman and Bishop 1975). Ione buckwheat and Ione manzanita can tolerate the acidic, nutrient-poor Ione soils and are essentially restricted to this soil type.

Habitat Trends

Fire suppression and reduced fire frequency have caused changes in the structure and species composition of large areas of chaparral. Longer intervals between fires has led to an increase in later successional species and slow-maturing species, greater standing biomass and dry fuels, and larger, more intense fires. Where fire is less frequent, many chaparral species decline. Also, roads, agriculture, and urban development have fragmented the habitat of some species. Changes in fire frequency and fragmentation and have contributed to the decline of several species.

Urban development increases local fire suppression efforts as well as directly removing chaparral habitat. Urban development in the foothills of the western Sierra Nevada, through expansion of residential neighborhoods and road construction and maintenance, has destroyed or degraded numerous populations of listed plants. Residential and commercial development around the communities of Cameron Park and Shingle Springs have caused the greatest losses in gabbro soils habitat. Fifteen active surface mines occur on private land near Ione, where the habitat of listed

plants continues to be degraded. Mining for quartz sand, clay, lignite, laterite, and gravel have destroyed a large proportion of the original habitat.

Coastal Scrub and Coastal Grasslands

Habitat Description and Associated Species

Coastal scrub is characterized by California sagebrush (*Artemisia californica*) and coyote brush (*Baccharis pilularis*), and the coastal grasslands are generally dense grasses in low lying areas or sparse grasses mixed with forbs on hilltops and ridges (balds). Coastal sagebrush occurs mostly on steep slopes and thin soils, and coyote brush is found in deeper soils with minimal slopes. The coastal grasslands are characterized by a mix of native and European grasses. Coastal scrub is typically found adjacent to and interspersed with coastal grasslands.

Callippe silverspot butterfly (*Speyeria callippe callippe*), Mission blue butterfly (*Icaricia icarioides missionensis*), and San Bruno elfin butterfly (*Incisalia mossil bayensis*) are federally listed species that are largely restricted to coastal scrub and coastal grassland on mountains in San Mateo County, including San Bruno Mountain, Montara Mountain, Milagra Ridge, Sweeney Ridge and Skyline College. Isolated colonies also remain locally in San Francisco, Solano, Alameda, Contra Costa and Marin Counties.

Coastal scrub and grasslands may include the federally listed Sonoma spineflower (*Chorizanthe valida*), yellow larkspur (*Delphinium luteum*), and Baker's larkspur (*D. bakeri*).

The Alameda whipsnake is found in coastal sage scrub and chaparral adjacent to grasslands in Contra Costa and Alameda counties. The habitat of this species has been subject to over 150 years of urbanization and over 100 years of fire suppression. The populations of this species are extremely disjunct and genetic exchange between the 5 remaining populations is extremely low or unlikely.

The following serpentine endemics, are found on serpentine outcrops in these habitats: Bay checkerspot butterfly (*Euphydryas editha bayensis*), Clara Hunt's milkvetch, coyote ceanothus (*Ceanothus ferrisae*), fountain thistle (*Cirsium fontinale* var. *fontinale*), Marin dwarf-flax (*Hesperolinon congestum*), Metcalf Canyon jewelflower (*Streptanthus albidus* var. *albidus*), San Benito evening-primrose, San Mateo thornmint (*Acanthomintha duttonii*), San Mateo woolly sunflower (*Eriophyllum latilobum*), Santa Clara Valley dudleya (*Dudleya setchellii*), showy Indian clover, Tiburon paintbrush (*Castilleja affinis* ssp. *neglecta*), and white-rayed pentachaeta.

Zayante soils are endemic to Santa Cruz County and occur predominantly near the communities of Ben Lomond, Felton, Mount Hermon, Olympia, and Scotts Valley, as well as the Bonny Doon area. Zayante soils are deep, coarse-textured, poorly developed, and well drained (USDA Soil Conservation Service 1980). A unique habitat within the Zayante sand hills ecosystem is sand parkland characterized by sparsely vegetated, sandstone-dominated ridges and saddles that support a wide array of annual and perennial herbs and grasses. Scattered ponderosa pine trees are often present. Species occurring in this habitat are Ben Lomond spineflower (*Chorizanthe pungens* var. *hartwegiana*), robust spineflower (*C. robusta*), and Ben Lomond wallflower (*Erysimum teretifolium*).

The following serpentine endemics, are found on serpentine outcrops in these habitats: Bay checkerspot butterfly, Clara Hunt's milkvetch, coyote ceanothus, fountain thistle, Hickmann's cinquefoil, Marin dwarf-flax, Metcalf Canyon jewelflower, Red Mountain campion, San Benito evening-primrose, San Mateo thornmint, San Mateo woolly sunflower, Santa Clara Valley dudleya, showy Indian clover, Tiburon paintbrush, and white-rayed pentachaeta.

Habitat Trends

Much of the former coastal scrub and grassland in the San Francisco Bay Area is urbanized. The majority of the remaining natural habitat is largely restricted to ridges and mountains that are difficult to build on. Coastal scrub and its associated grasslands in San Mateo County have largely been destroyed or degraded by urbanization. The remaining isolated fragments are expected to be developed in the near future. In addition to urbanization, habitat modifications through changes in hydrology and fire frequency, as well as invasion of non-native species, are still affecting most habitats. The map developed by Küchler (1977) estimates that potential natural vegetation within the CALFED Program Focus Areas included 340,294 acres of coastal scrub habitat. In 1990, coastal scrub habitat within the CALFED Program Focus Areas had been reduced to124,075 acres (GAP 1996), representing a decline of 64% from the potential natural vegetation estimated by Küchler (1977).

Although serpentine habitats are naturally fragmented and separated by areas of different geology and soils, serpentine habitats in the San Francisco Bay area have been severely reduced and fragmented by urban development and related activities in recent decades (Kruckeberg 1984; 57 FR 59053).

Role of Contaminants in the Decline of Species and Habitats

Drainage Water and Selenium Contamination

Soils on the west-side and southern end of the San Joaquin Valley are derived from marine sediments in the Coast Range and contain naturally high levels of arsenic, boron, chromium, molybdenum, and selenium, which are toxic or potentially-toxic trace elements. Evaporation has caused high concentration of these elements in near-surface soils and groundwater in those areas, and application of irrigation water increases these concentrations. Subsurface clay, underlying these contaminated soils, impedes vertical and lateral movement of irrigation water percolating below the root zone (Moore et al. 1990), causing a drainage problem.

To move contaminated water out of these saturated soils, deep ditches have been dug or subsurface drainage systems installed. The drainage systems take away harmful salts and excess moisture, thus lowering the water table to below the root zone for most crops. The effluent from these drains often contains salts, trace elements, and agricultural chemicals. Subsurface agricultural drainage water collected in such systems is pumped away or allowed to drain into surface ditches and canals, eventually discharged into ponds for evaporative disposal, or creeks or sloughs tributary to major streams and rivers. On average, approximately 0.7-0.8 acre-feet of subsurface drainage water is generated annually per acre of irrigated agricultural land on the west side and southern end of the San Joaquin Valley (San Joaquin Valley Drainage Program 1989). The historic and continuing discharge of subsurface drain water into surface waters of the San Joaquin Basin has resulted in degradation of surface- and groundwater quality through salinization and contamination by elevated concentrations of toxic or potentially toxic trace elements and agricultural chemicals.

In the drainage-impaired areas, evaporation ponds and agroforestry plantations are used for disposal of contaminated drain water. In 1990, 28 evaporation ponds (about 7,400 total acres) were utilized to dispose of drain water in Merced, Kings, Kern, and Tulare Counties. These ponds received approximately 30,000-40,000 acre-feet per year from a total of about 55,000 acres of irrigated lands (San Joaquin Valley Drainage Program 1990). Since 1990, the total acreage of evaporation ponds/basins has declined from about 7,000 acres to about 5,000 acres. The ponds are regulated by the Regional Water Quality Control Board by means of Waste Discharge Requirements (e.g., Order No. 93-136) that require creation of clean wetlands to mitigate unavoidable toxic impacts to breeding waterbirds.

Agroforestry disposal of drain water involves irrigation of various combinations of salt tolerant crops, shrubs, and trees with subsurface drainage wastewater. More than 40 agroforestry

drainage water disposal sites were established between 1985 and 1990 (Moore et al. 1990). Given current trends in rising ground water elevations and the general lack of acceptable disposal options other than agroforestry sites, it is expected that the expansion of agroforestry sites will exponentially accelerate within a 5-10 year planning horizon. Although it has been established that agroforestry plantations (like evaporation basins) are wildlife magnets in the extensively cultivated landscape of the San Joaquin Valley (Moore et al. 1990), the potential for contaminant hazards remains poorly documented. A small set of waterbird eggs collected by the Service from just two agroforestry sites in 1996 yielded the highest rates of selenium-induced embryonic malformation ever reported in the scientific literature (Skorupa 1998) and established that the method of furrow irrigation being used was attracting breeding waterbirds.

The extent and severity of the drainage problem in the western and southern San Joaquin Valley continues to worsen. Between 1991 and 1997 the acreage of land in the southern San Joaquin Valley with shallow groundwater rising to within 5 feet of the soil surface–having a drainage problem--has increased from 159,000 acres to 359,000 acres (DWR 1997); therefore, in the past 6 years, an additional 200,000 acres of agricultural lands have been added to the inventory of parcels requiring a disposal option for drainage water to stay in production. Land retirement (retirement from irrigation) is being planned in this area (on a willing seller basis) to remove the lands with the greatest drainage problem from production.

Pesticides

Insecticides, herbicides, and rodenticides have been used for decades throughout the Central Valley, including the CVP service area. Farmers have used insecticides to eliminate crop damage caused by harmful insects and herbicides to reduce crop competition with weeds and other undesirable plants. Rodenticides have been used primarily to reduce or eliminate populations of ground squirrels and other burrowing rodents that can damage flood control levees and water delivery systems.

Beginning in the 1950's synthetic organochlorine (DDT, dieldrin, aldrin, endrin, toxaphene, lindane, chlordane, heptachlor, and Mirex) and organophosphate (*e.g.*, carbaryl and carbofuran) pesticides were extensively and increasingly used. Several organochlorine compounds persist in the soil for many years. In the Central Valley, the California brown pelican, American peregrine falcon, osprey, bald eagle, and California condor were seriously affected by DDT. Use of DDT was banned in the United States in 1972, and all of these species have increased their populations since that time. However, some birds may still be contaminated as a result of illegal or foreign application of DDT.

The quantity of pesticides used in the State--over 120 million pounds in 1980 alone (California Department of Food and Agriculture 1981)--is, in part, a result of the types of crops grown. For example, traditional cotton production uses more pesticides than production of any other crop (Service, undated). Acreage devoted to cotton production in the Tulare Basin increased by 330% between 1940 and 1980. During 1978, about 1.7 million acres in the Central Valley were devoted to cotton production, more acreage than for any other crop (~27% of the irrigated acreage in the Central Valley). The vast majority of the Central Valley's cotton production occurs within the San Joaquin Valley (Reclamation 1984). Of the almost 70 million pounds of pesticides applied in the Central Valley during 1980, a substantial proportion was used to produce cotton in the San Joaquin Valley (California Department of Food and Agriculture 1981).

Effects of Proposed Action

This section discusses the effects of the proposed action on listed, proposed, and candidate species and their critical habitat, including the effects of actions that are interrelated and interdependent with the proposed action that will be added to the environmental baseline. Cumulative effects, which are discussed separately after this section, are the effects of future State, local, or private activities, not involving Federal activities, that are reasonably certain to occur in the action area. Effects are analyzed on an ecosystem level, including all species that could be impacted by the actions. Specific information on individual species can be found in the species accounts in Appendix C. Species of Concern are included in Appendix C for the purposes of providing technical assistance for these species. Specific information on habitat types and trends can be found in the Environmental Baseline section of this opinion.

Direct and Indirect Effects

Direct effects include those effects that are the direct result of the proposed action. Indirect effects are caused by or result from the proposed action, are later in time, and are reasonably certain to occur. Direct and indirect effects include the effects of interrelated actions (actions that are part of the larger proposed action and depend on the larger action for their justification) and interdependent actions (actions having no independent utility apart from the proposed action).

Scope and Distribution of Effects

The direct and indirect effects of the CALFED Program can occur in the legal Delta, Suisun Marsh and Bay, lands within the Central Valley watershed, the Santa Clara Valley watershed, the upper Trinity River watershed, the southern California water system service area, San Pablo Bay,

and San Francisco Bay by actions such as water impoundments and diversions, agricultural conversion and related operations, urban development, and operations and maintenance of the CALFED Program. Listed species and critical habitat occur throughout the study area on (1) native habitats, (2) agricultural lands, and (3) marginal habitats surrounding reservoirs, conveyance facilities, pumping plants, urban centers, and agricultural lands. Activities associated with the CALFED Program may thus directly or indirectly affect listed species or their critical habitat. For example, upstream water diversions affect the aquatic and riparian species downstream of the diversion. In addition, upland habitats supporting listed species are being converted to agricultural or urban land uses facilitated by availability and use of CVP/SWP water supplies. The CALFED Program may contribute to this habitat loss by improving the supply and reliability of CVP/SWP water.

Timing of Effects

CVP/SWP water is diverted year-round, although the majority is delivered during the spring and summer growing seasons. Water impoundments capture heavy winter and spring run-offs, and diversions reduce water available during other parts of the year. Many species of fish require adequate flows during sensitive periods of their life cycle. Flood flows and spring runoff enhance the ecosystem when they: (1) scour out blocked channels to allow upward migration of fish, (2) supply cool, fresh water needed for spawning, (3) inundate essential spawning habitat to allow for spawning, and (4) assist out-migration of juvenile fish.

Activities associated with agricultural operations often occur during sensitive periods of terrestrial species' life cycles. Ground disturbance and pesticide application often occur during reproductive effort and juvenile growth. Breeding, feeding, and foraging of listed species can be disrupted by agricultural operations during mating, denning, nesting, whelping, or other reproductive behavior.

Loss of adequate flows needed to sustain listed and proposed aquatic species can reasonably be expected to reduce appreciably the likelihood of survival and recovery of those species. However, this should not be the case given the assumptions that (1) the CALFED Program will be implemented in a manner consistent with achieving the recovery goals for listed species identified in the MSCS; (2) actions identified in the ERP will be implemented; (3) the EWA will be implemented as described; (4) flow objectives identified in the ERP will be achieved; and (5) any future storage and conveyance improvements will undergo future tiered section 7 consultation to ensure these improvements are consistent with the conservation needs of listed species and the conservation aspects of the CALFED Program, including the ERP, EWA, MSCS, and Water Quality Plan.

Agricultural operations during the breeding seasons of terrestrial species can reasonably be expected to reduce the likelihood of survival and recovery of listed and proposed species. However, this should not be the case given the assumptions that (1) any site-specific direct and indirect effects to listed species associated with projects that trigger consultation requirements under section 7 or section 10 will be consulted upon following project-specific analysis and prior to the effect; (2) implementation of the ERP, MSCS, and recovery plans will be an integral part of project-specific consultation; (3) ongoing monitoring and mapping of listed and proposed species baselines is occurring through the Science Program; and (4) listed species baselines are increasing, or at least stable, based upon monitoring.

Nature of the Effects

The pumping, delivery, and application of CVP/SWP water can adversely affect various aspects of the biology of listed species, including reproduction, growth, survival, migration, predator avoidance, and foraging. Conversion of habitats resulting from the construction and operation of CVP and SWP facilities has eliminated or greatly reduced habitat available to listed species. Activities such as water impoundments and diversions, agricultural land conversions and related operations, municipal and industrial development, and operations and maintenance are likely to continue to directly and indirectly affect listed species and their habitat. A detailed description of the nature of the effects of the pumping, delivery, and application of CALFED Program water follows. See Table 5 (following page) for habitats adversely affected by CALFED Program activities. A more complete explanation of habitat trends can be found in the Environmental Baseline section of this opinion.

Table 5. Activities associated with the CALFED Program and the habitats that may be directly or indirectly adversely affected. Actual effects would be determined during tiered project-specific review. An "X" denotes those activities that have the greatest impact on the habitat type, although the other activities may have an impact as well.

Habitat Type	Levee Integrity Program	Water Quality Program	Ecosystem Restoration Program	Water Use Efficiency Program	Water Transfer Program	Watershed Program	Storage	Conveyance	Science Program
Delta Aquatic Habitats	X	X	X	X	X	X	X	X	X
Vernal Pool Habitats			X		X	X	X	X	X
Freshwater Wetland Habitats	X	X	X	X	X	X	X	X	X
Riparian Habitats	X	X	X	X	X	X	X	X	X
Coastal Beach/ Lagoon/Dune Habitats			X	X	X	X	X	X	X
Salt Marsh Habitats	X	X	X	X	X	X	X	X	X
Interior Grassland Habitats	X		X	X	X	X	X	X	X
Alkali Scrub Habitats				X	X	X	X	X	X
Oak Woodland Habitats				X	X	X	X	X	X
Evergreen Hardwood and Coniferous Habitats				X	X	X		X	X
Chaparral Habitats				X	X	X	X	X	X
Coastal Scrub/ Grassland				X	X	X	X	X	X

Water Impoundments and Diversions

Water impoundments and diversions include: construction and upgrading of dams, levees, pumping plants, and conveyance facilities; diversion of water out of the natural water course; and conveyance of the water to a different location. These activities have caused the loss and degradation of listed species habitat such as Delta aquatic habitat, wetlands, riparian corridors, coastal beaches and lagoons, and salt marshes. Diversions reduce the water available to water-dependent listed species such as Delta fishes and riparian- and wetland-dependent species.

The direct and indirect effects of water impoundments and diversions include the following:

1. Effects of impoundment, pumping and conveyance on fish include: direct mortality from pumping activities; mortality when listed fish and their predators are drawn into confined areas (such as the Clifton Court Forebay), leaving them vulnerable to predation; entrainment of fish into water diversion facilities where they are killed by the pumps; reverse flows of waters in the Delta and San Joaquin River which confuse fish and disrupt migration; diversion of fish into canals from which they cannot return to suitable breeding and foraging habitat; prevention of upstream migration by dams; dewatering of portions of the San Joaquin River upstream of its confluence with the Merced River that has eliminated native salmonids from the upper San Joaquin watershed; alteration of the magnitude, timing, and duration of flows; prevention of heavy spring run-off; constriction of low salinity habitat to deep-water river channels of the interior Delta; destruction of spawning, rearing, and refugial habitat; scouring of spawning areas by high flow releases from dams; changes in the hydrologic patterns in Delta waterways; movement of the mixing zone (X2) upstream from compliance points to the interior of the Delta, where foraging and breeding habitat is poor in quality and limited in area; delays in correcting Delta flow problems, caused by time lags of one to three days between water releases from CVP/SWP reservoirs and arrival of water in the Delta; water temperature fluctuations; and loss and degradation of shallow water habitat and salt marsh habitats.

2. Flow regulation affects vegetation structure by preventing regeneration of riparian corridors, changing salt marsh vegetation by altering salinity variability patterns, and degrading coastal lagoons. The vegetation in marshes around Suisun Bay has been increasingly converted from brackish to saltmarsh species due to the diversion of freshwater from the Delta, which has been further exacerbated by droughts. In addition, seasonal and annual variation in flows has been dampened, reducing the

effectiveness of dramatic vegetation shifts that is favored by some listed and sensitive plants and animals.

3. Construction of dams, pumping and conveyance facilities, and levees, as well as preparation of these sites for construction, have footprint effects that cause: direct loss of riparian bottomlands, salt and freshwater marsh and shallow water habitats, grasslands, vernal pools, and other upland habitats; flooding of riparian valleys and degradation of downstream riparian corridors; changes in hydrology and potentially to aquifers; and altered dispersal patterns of terrestrial species due to impassible barriers.

Construction of new facilities, raising existing dam elevations, and modifications of operating parameters of existing facilities may increase the amount of water available, thereby facilitating the continued conversion of native habitat as described below. Project-specific information is needed for a full determination of impacts of new facilities or modifications of existing facilities and operations, so these actions are not covered in this opinion.

Decline of habitats and species numbers would be expected to continue if the volume or reliability of water diversions and impoundments increase. In the absence of adequate conservation and recovery measures, degradation of listed species habitats and lack of recovery of certain listed species would be expected to continue as long as significant amounts of water continue to be impounded and diverted.

Water impoundments and diversions have ultimately led to the listing of many species and can reasonably be expected to reduce the likelihood of survival and recovery of listed and proposed species. However, this should not be the case given the assumptions that: the CALFED Program will be managed in a manner consistent with the ERP, MSCS, and Water Quality Program; flow standards identified in the Water Management Strategy, including the EWA and its Operating Principles will be met; CALFED Agencies do not implement additional discretionary actions (e.g., new contracts, contract amendments, facility construction) that would incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until consultation on OCAP or other existing biological opinions is reinitiated and new consultations are completed; conservation actions and assumptions described in the **Description of the Proposed Action** of this opinion are fully implemented; discharges into surface water bodies by CALFED Agency water contractors resulting from CALFED Agency water impoundments and diversions will comply with the standards set in the biological opinion on the California Toxics Rule (file number 1-1-98-F-21); CALFED Agencies will consult on changes in quantities of deliveries, and in purpose of use under water contracts subject to ESA compliance from Agriculture to

Agriculture/Municipal and Industrial, where listed species may be affected; monitoring is implemented which shows that the baselines of the species in Appendix C are stable or increasing.

Agricultural Conversions and Related Operations:

Agricultural conversions and related operations that will likely be either directly or indirectly facilitated by the CALFED Program include: conversion of native habitats to agricultural fields; conversion of land use to more water intensive purposes; disposal of agricultural drainwater; application of pesticides; and mowing and harvesting operations. Agricultural conversion and related operations have contributed to the loss and degradation of listed species habitat such as Delta aquatic habitat, vernal pools, wetlands, riparian habitats, coastal habitats, grasslands, alkali scrub, oak woodlands, rare serpentine soil habitats, and Antioch dunes habitat. Most of the other types of habitats considered in this opinion have also been affected to some degree by agricultural operations.

The direct and indirect effects of agricultural conversions and related operations subject to section 7 consultation may include the following:

1. Direct loss of upland, riparian, and wetland habitats when native habitats are converted to irrigated agriculture either with associated CVP/SWP allocations or in anticipation of CVP/SWP allocations (e.g., via water transfers, water freed-up by water conservation actions). Conversion of native habitats such as vernal pools and associated uplands occurs by means of plowing and deep-ripping and reduces or eliminates the habitat's suitability for listed species.

2. Potential direct loss of upland, riparian and wetland habitats with the use of new water supplies from raising dams of existing project facilities, from building new project facilities, and from changes in operations improving water supply reliability.

3. Conversion of native habitats to irrigated agriculture indirectly facilitated by the CALFED Program via the following means:

    a. Use of groundwater augmented by the CALFED Program via 1) recharge from the application of CVP/SWP water to agricultural land; 2) recharge from adjacent project facilities; or 3) recharge from CVP/SWP water applied to water banks.

b. Use of tail water produced from application of CVP/SWP water to agricultural land.

c. Use of recycled water on agricultural land produced from application of CVP/SWP water to municipal and industrial development.

d. Use of additional water, locally or through water transfers, made available through the Water Use Efficiency Program.

4. Degradation and fragmentation of remaining habitat, potentially without regard for the need of dispersal corridors, greatly reduces its value for listed species.

5. Effects to aquatic habitats from agricultural run-off including siltation of stream habitat and reduced water quality.

6. Effects from agricultural drainwater contamination, an unwanted byproduct of irrigating poorly drained soils on the westside of the San Joaquin Valley include: reduced water quality (*e.g.,* high concentration of total dissolved solids); degradation of surface- and groundwater quality through salinization and contamination by elevated concentrations of toxic or potentially toxic trace elements (*e.g.,* arsenic, boron, chromium, molybdenum, and/or selenium); direct loss of habitat from construction of on-farm disposal options such as evaporation ponds and agroforestry plantations; and adverse biological effects in native species associated with drainage-contaminated habitats. The effects of selenium poisoning on avian species include: gross embryo deformities, winter stress syndrome, depressed resistance to disease due to depressed immune system function, reduced juvenile growth and survival rates, mass wasting, loss of feathers (alopecia), embryo death, altered hepatic enzyme function, and mortality. The potential effects of selenium on mammal species include: gross embryo deformities, reduced longevity, winter stress syndrome, depressed resistance to disease due to depressed immune system function, reduced juvenile growth and survival rates, food aversion and mass wasting, loss of hair and nails, reduced reproductive success, skin lesions, respiratory failure, lameness, paralysis, and mortality. Little information is available for the effects of selenium on reptiles and amphibians. Due to the close phylogenetic relationship between birds and reptiles, reptiles are likely to be similarly effected by selenium as birds. Effects of selenium on fish include: gross embryo deformities. growth inhibition, depressed immune response, mass wasting, changes in blood parameters and tissue structure, edema, reduced activity and

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feeding, reduced survival, and mortality. The synergistic effects of selenium and mercury include embryo deformities, embryo death, reduced juvenile survival, behavioral abnormalities, depressed immune response, mass wasting, and mortality.

7. Insecticides, herbicides, and rodenticides applied to agricultural lands can adversely affect listed species by: direct mortality; secondary poisoning of predators and scavengers; degradation of habitat quality following herbicide application; loss of prey base after pesticide application; reduced water quality; impacting native habitat through pesticide and herbicide drift; and loss of pollinators.

8. Effects to terrestrial species include: loss of upland refugia near aquatic habitats; altered migration and dispersal patterns of animals due to large tracks of agricultural land; reduced likelihood of seed dispersal across agricultural fields; reduced survival in degraded habitats within and around agricultural operations; and reduced survival due to necessary operations such as mowing and harvesting.

Land conversion from native habitat to farmland is facilitated in part (directly or indirectly) by the supply of water, and continues to occur. The California Department of Forestry and Fire Protection (1988) predicted a net loss of 775,000 acres of native habitat in the Central Valley from 1980-2010. Between 1990 and 1996, a gross total of approximately 72,700 acres of native habitat were converted to farmland in 30 counties in the Conservation Program Focus area (California Department of Conservation 1994, 1996, 1998). Net trends in agricultural acreage were negative over this period due largely to land idling in the southern San Joaquin Valley. To identify trends over a longer period, we analyzed DWR land use data collected from 1972 to 1998 for 21 counties in the Central Valley and Central Coast. Although complicated by non-synchronous surveys and inconsistencies in survey area, analysis of these data indicates that net conversion of native habitat to agricultural and urban uses has averaged about 24,000 acres annually. Gross losses of native habitat have been considerably larger, because the net loss includes substantial increases in the "native" category from long-term idling or retirement of farmland. These recently created native lands may not constitute high-quality habitat for listed species. Expansion of agriculture into marginal or upslope lands continues to affect native habitat. The Service has identified at least 9,820 acres of endangered species habitat on 16 sites in Fresno, Kern, Madera, Merced, and Tulare Counties that have been lost to unpermitted conversions between 1997 and 1999. Changes to more intensive farming practices (from dryland farming to irrigated agriculture or from discing to deep-ripping) also can increase the severity of agricultural impacts on endangered species. Continued conversion of native habitats is one of the

greatest threats to the survival of listed species in the Central Valley. The number of listed species in California continues to rise, in large part due to the loss and degradation of habitat from agricultural conversion. Conversions will continue to occur as irrigated/cultivated agriculture in the Central Valley continues to expand.

The effects of CVP/SWP water deliveries on groundwater recharge may have indirect effects on native habitats. The CVP/SWP supplies a significant portion of the irrigation water contributing to aquifer recharge by surface diversion irrigation. In addition, the CALFED Program will evaluate options for increasing groundwater storage in aquifers in the Central Valley. Groundwater pumping is used in many areas of the Central Valley to substitute for or supplement surface diversion irrigation water during dry years (Williamson *et al.* 1989). As a result, the CALFED Program may contribute to effects on irrigated farmlands and urban uses of water in the Central Valley. Any future evaluation regarding the adverse effects associated with land use changes would take into consideration the very complex interactions between surface and ground waters, the lack of data in many areas as to sources of water used at different times and in different years for irrigation and urban purposes, and the general lack of complete information on groundwater basin characteristics and use, and the complex economic and other factors related to groundwater use conditions.

Decline of habitats and additional listing of species is expected to continue if conversion of native habitat for agricultural purposes continues. Degradation of listed species habitats and lack of recovery of certain listed species is expected to continue as a result of continued agricultural operations and indirect effects of those operations.

Agricultural conversions, which can be an indirect effect of water impoundments and diversions, have ultimately led to the listing of many species and can reasonably be expected to reduce the likelihood of survival and recovery of these species. However, this should not be the case given the assumptions that: site-specific effects to listed species will be consulted upon following project-specific analysis and prior to the effect; implementation of the ERP, MSCS, and recovery plans will be an integral part of site-specific consultation; CALFED agencies will work closely with the water users, providing them maps of listed species habitats within their service areas and guiding them through the consultation process to address site-specific effects; conservation strategies identified in the MSCS for service-area impacts will be in place for districts or areas receiving water made available through the CALFED Program; the Water Management Strategy, including the EWA, are implemented consistent with operating principles and species recovery goals; CALFED agencies will not implement additional discretionary actions beyond those listed in the OCAP biological opinion, this biological opinion, or any other previously completed biological opinion (e.g., new contracts, contract amendments, facility construction) that would

incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until consultation on OCAP is reinitiated and completed; CALFED agencies and contractors comply with all programmatic and tiered opinions related to the CALFED Program; the CALFED Program will ensure full implementation of the conservation actions described in the **Description of the Proposed Action** of this opinion, including the ERP, MSCS, and Water Quality Program; discharges into surface water bodies by CALFED agencies resulting from CALFED Program-related water impoundments and diversions will comply with the standards set in the biological opinion on the California Toxics Rule (number 1-1-98-F-21); CALFED agencies will consult on all changes in quantities of deliveries and in purpose of use under water contracts subject to ESA compliance from Agriculture to Agriculture/Municipal and Industrial, where listed species may be affected; and Science Program monitoring is implemented which shows that the baselines of the species in Appendix C are stable or increasing.

Municipal and Industrial Development

Municipal and industrial development facilitated by the CALFED Program could include the following: conversion of native habitat to municipal and industrial uses; conversion of agricultural land for municipal and industrial uses; construction of infrastructure and supportive networks; pesticide and herbicide application; and recreational uses. Municipal and industrial development has contributed to the loss and degradation of all of the habitats described in the Baseline section of this opinion.

The direct and indirect effects of municipal and industrial conversions that may be facilitated by the CALFED Program include the following:

1. Direct loss of upland, riparian and wetland habitats when native habitats are converted to municipal and industrial land use either with associated CVP/SWP allocations or in anticipation of CVP/SWP allocations (e.g., via water transfers, water freed-up by water conservation actions or land retirement). Conversion of native habitats to municipal and industrial development eliminates the habitat's usefulness for listed species.

2. Potential direct loss of upland, riparian and wetland habitats can occur with new supplies from raising dams of existing project facilities or from building new project facilities.

3. Conversion of native habitats to municipal and industrial development may occur via the following means:

a. Use of groundwater augmented by the CALFED Program via (1) recharge from the application of new water supplies to agricultural land; (2) recharge from adjacent new facilities; or (3) recharge from water applied to water banks.

b. Use of recycled water produced from application of CALFED Program water to municipal and industrial development.

4. Degradation and fragmentation of remaining habitat, potentially without regard for the need of dispersal corridors, reducing its value for listed species, including extreme degradation of rare habitats found only in a certain region (*e.g.,* serpentine and gabbro soils).

5. Recreational disturbance effects including: off-road vehicle use which disturbs and degrades habitats such as dunes; recreational use of beaches that degrades habitat; trampling by hikers, dogs, and horses; disturbance to the normal behavioral patterns of native species; and other human recreational disturbances that degrade upland habitat and disrupt the natural cycles of native species.

6. Development of infrastructure and supportive activities including: road construction and maintenance which eliminates, fragments, and disturbs habitat; energy development that eliminates upland habitat; freshwater discharges from waste water facilities that alter salt marsh habitats; fire suppression for protection of human habitations, resulting in degradation of fire-dependent habitats such as chaparral; clearing of uplands for fire breaks; power line installation and maintenance; and waste disposal sites that eliminate habitat such as serpentine soils.

7. Effects from urban development including: increased erosion; increased roadkill incidence; increased pesticide use; increased predation by pets and introduced animals such as red foxes; and reduced water and air quality.

It has been estimated that between 12,000 and 50,000 acres of land are converted from agricultural use to urban use per year in the Central Valley of California, a number that is expected to increase in the future (Sokolow, 1997). Conversion of agricultural land to urban use between 1995 and 2040 has been predicted to exceed 1,000,000 acres (Thompson et al. 1995). Between1990 and 1996, approximately 101,700 acres were converted to urban land use in 30 counties in the Conservation Program Focus area (California Department of Conservation 1994,

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1996, 1998). This figure includes 49,705 acres of farmland, 20,476 acres of grazing land, 113 acres of water, and 31,366 acres of other land (predominantly native habitat). Urban lands are unsuitable habitat for many species that are able to persist in agricultural landscapes, and are virtually impossible to restore as wildlife habitat. Because one acre of irrigated agricultural land requires more water than that same acre in urban use, conversion of agricultural land to municipal and industrial use frees up some water that might be used to convert additional native habitat. Reducing water deliveries during drought is also more difficult on urban lands than on agricultural lands, so agricultural to urban conversions reduce the flexibility of the CALFED Program to respond to water shortages.

Several rare habitat communities (such as those on gabbro soils and serpentine soils) are currently under increasing pressure to be developed for municipal and industrial uses. Decline of habitats and species numbers is expected to continue as urban expansion persists and the population of California continues to rise. Degradation of listed species habitats and lack of recovery of certain listed species is expected to continue as a result of indirect impacts from urban centers.

Municipal and industrial development, which can be an indirect effect of water impoundments and diversions, can reasonably be expected to reduce the likelihood of survival and recovery of these species, because once the development has occurred, the opportunity of utilizing the land to contribute to survival and recovery is foreclosed. However, this should not be the case given the assumptions that: site-specific effects to listed species will be consulted upon following project-specific analysis and prior to the effect; implementation of the ERP, MSCS, and recovery plans will be an integral part of site-specific consultation; CALFED agencies will work closely with the water users, providing them maps of listed species habitats within their service areas and guiding them through the consultation process to address site-specific effects; conservation strategies identified in the MSCS for service-area impacts will be in place for districts or areas receiving water made available through the CALFED Program, where appropriate; the Water Management Strategy, including the EWA, are implemented consistent with operating principles and species recovery goals; CALFED agencies will not implement additional discretionary actions (e.g., new contracts, contract amendments, facility construction) that would incrementally increase diversions and alter hydrologic and environmental conditions in the Delta until consultation on OCAP is reinitiated and completed; CALFED agencies and contractors comply with all programmatic and tiered opinions related to the CALFED Program; the CALFED Agencies will ensure full implementation of the conservation actions described in the **Description of the Proposed Action** of this opinion, including the ERP, MSCS, and Water Quality Program; discharges into surface water bodies by CALFED agencies resulting from CALFED-related water impoundments and diversions will comply with the standards set in the biological opinion on the California Toxics Rule (number 1-1-98-F-21); CALFED agencies will consult on all changes in

quantities of deliveries and in purpose of use under water contracts subject to ESA compliance from Agriculture to Agriculture/Municipal and Industrial, where listed species may be affected; Science Program monitoring is implemented which shows that the baselines of the species in Appendix C are stable or increasing.

Operations and Maintenance

Operations and maintenance activities include mowing, levee maintenance, dredging, pest control, erosion control, and flood control. Operations and maintenance activities can contribute to loss and degradation of most of the habitats listed in the **Environmental Baseline** section, but have the most impact on Delta aquatic habitats, vernal pools, wetlands, riparian habitats, grasslands, and alkali scrub.

The direct and indirect effects of operations and maintenance activities can include the following:

1. Canal maintenance or dredging that disturbs wetland habitat, increases siltation, and disturbs the normal behavior of listed aquatic species.

2. Direct mortality from vehicle traffic, mowing, and burning on levees and near canals.

3. Flood control (including flow restrictions, levee maintenance and installation of riprap) can interfere with the natural regeneration processes of forests and alter other upland and wetland habitats by removing vegetation or changing patterns of disturbance and sediment deposition.

4. Continued disturbance of habitats around facilities through maintenance activities prevents reestablishment of native habitat and disturbs hibernating or denning species.

5. Insecticides, herbicides, and rodenticides applied around facilities can adversely affect listed species through: direct mortality; secondary poisoning of predators and scavengers; degradation of habitats following herbicide application; loss of prey base after pesticide application; reduced water quality; pesticide and herbicide drift; and loss of pollinators.

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Degradation of listed species habitats and mortality and disturbance of listed species is expected to continue as a result of continued operations and maintenance activities associated with CALFED Program facilities.

Operations and maintenance activities can reasonably be expected to reduce the likelihood of survival and recovery of these species. However, this should not be the case given the assumptions that: O&M plans are developed and implemented by CALFED Agencies and are consistent with section 7(a)(1) of the ESA; CALFED agencies will ensure full implementation of conservation actions described in the **Description of the Proposed Action** of this opinion, including the measures identified in the ERP, MSCS, and Water Quality Program; site-specific effects to listed species will be addressed through project-specific analysis and implementation of avoidance, minimization, and compensation measures in compliance with the MSCS and this opinion; implementation of and conformance with the ERP, MSCS, and recovery plans will be an integral part of management actions; discharges into surface water bodies resulting from CALFED Program water impoundments and diversions will comply with the standards set in the biological opinion on the California Toxics Rule (Service File # 1-1-98-F-21); monitoring is implemented which shows that the baselines of the species in Appendix C are stable or increasing.

Duration

The temporal effects of the CALFED Program can be divided into three types, based on duration of effect.

1. Short-term events whose effects are relaxed almost immediately. Routine maintenance activities tend to be short-term events.

2. Sustained, long-term events whose effects are not relaxed. Water flows vary from year to year depending on available flows and contract deliveries. The continued impoundment, pumping, and diversion of water has long-term effects on species dependent on historical water flows.

3. Permanent events that set a new threshold for some feature of a species' environment. The construction of dams and the corresponding loss of a riparian corridor and the surrounding land due to flooding is an example of a permanent event. Conversion of land for intensive agricultural uses or urban centers also permanently removes that habitat for use by listed species dependent on that habitat.

The CALFED Program was initiated to provide a steady water supply to water users. As such, the effects of the CALFED Program tend to be sustained events or permanent changes.

Disturbance Frequency, Intensity, and Severity

Water is diverted every year to fulfill various water rights and water contracts. Most agricultural fields are irrigated every year, although the intensity of irrigation may vary from year to year depending on available water. Some fields are fallowed each year. In the event of a prolonged low-flow period, the effect of continued diversions on listed species would be greater. Pesticides are applied every year, often more than once a year, on most fields.

Conversions of habitat indirectly caused by the CALFED Program could reduce the range of many listed species. Listed species may or may not be able to recover from repeated disturbance, depending on the sensitivity of the species, the severity of the disturbance, and the other stressors in its environment. Listed species tend to be more sensitive to disturbance and habitat loss, simply due to their restricted range. Each species will react differently to the disturbance. Refer to the individual species accounts in Appendix C for explanation of the reasons for decline and sensitivity to disturbance.

Even relatively small land conversions indirectly caused by the CALFED Program in rare habitats such as gabbro soils, serpentine soils, dunes, and vernal pools can significantly reduce the range of already rare species. This can be especially true of listed plant species that are dependent on specific soil types for survival, as well as the animal species that utilize those plants.

The disturbances and habitat loss that could be caused by the CALFED Program could leave species more vulnerable to other stressors in their environment, such as floods, drought, fires, disease, pollution, and predators. Species with severely restricted ranges become vulnerable to inbreeding, hybridization with other subspecies, and genetic drift. Severe or moderate disturbances can decrease the recovery rate of a species or reduce the chances of recovery. Many direct, indirect, interrelated, and interdependent effects of the CALFED Program are expected to occur.

Effects of CALFED Program Elements

Levee System Integrity Program

The Levee System Integrity Program includes programs to: reconstruct Delta levees to a uniform base-level of protection; provide above base-level flood protection for some Delta islands; minimize risks to levee integrity due to subsidence; enhance existing emergency management response; prepare a Delta Levee Risk Assessment and Risk Management Strategy; evaluate the appropriate level of protection for Suisun Marsh levees and evaluate the best method of protection; and facilitate funding and the permitting process for these projects. Similar programs have been implemented throughout the CALFED Program study area in the past by the Corps of Engineers, DWR, and local jurisdictions. Programs that have affected listed species include PL 84-99, Sacramento River Flood Control System Evaluation, Sacramento Bank Protection Program, American River Watershed Investigation, and numerous other smaller programs and local projects. Such activities in the past have caused habitat loss, fragmentation and degradation; habitat conversion; disrupted vital behavior such as reproduction, foraging and escape from predators, and resulted in direct take through construction and maintenance activities. Similar projects have impacted Delta aquatic habitats, vernal pool habitats, wetlands (permanent, seasonal, freshwater, brackish), riparian corridors, grasslands and coastal habitats. Site-specific information has not yet been developed for projects to be implemented under the Levee System Integrity Program, so these actions are not covered by this opinion. Discussion of effects of the program are based on the types and scope of projects expected.

Direct effects:

Projects to reconstruct levees to a uniform base-level of protection, increase protection above base-level, and to minimize subsidence and increase levee integrity may result in take through construction activities. Listed species may be killed or injured by construction equipment, during dredging, excavation, and fill, and may suffer vehicular mortality from increased traffic from construction and personnel vehicles accessing construction areas. Dewatering during construction may result in stranding and mortality of aquatic species. Normal behavior patterns may be disrupted by construction activities, impairing breeding, feeding and sheltering. Listed species may be displaced into unsuitable habitats and may suffer increased risk of vehicular mortality, predation, intra- and interspecific competition, disease, and starvation. Use of dredge materials in levee repair could mobilize contaminants bound to Bay and Delta sediments and could result in death or injury of listed species. Contaminants released during dredging and use of dredge materials may result in impaired reproduction, foraging, and sheltering, and increased susceptibility to disease and predation.

Habitat modification as a result of construction activities may also impair essential behaviors such as breeding feeding, and sheltering. Habitat may be lost or degraded due to construction activities. Vegetation may be cleared and grubbed from construction areas, resulting in a loss of habitat (both temporary and permanent), protective cover, retreat sites, movement corridors, and foraging areas. Removal of vegetation may result in increased flows, runoff, erosion, and siltation.

Increasing base levels of protection may result in standardization of levee profiles, resulting in increased levee footprints. Construction of expanded levee profiles may result in loss of habitat on and adjacent to existing levees, including loss of riparian vegetation, wetlands, agricultural lands that provide habitat values, grasslands, and aquatic habitats. Techniques to increase levee integrity, such as stability and seepage berms, will also increase levee footprint/profiles and may result in loss and degradation of habitats. Other methods to control seepage, such as eliminating or relocating canals, waterways, and seasonal and permanent wetlands near levees, may result in temporal and permanent loss of habitat. Geotechnical engineering practices (such as geotechnical fabric, soil over rock designs) may decrease a levee's ability to support vegetative cover and result in permanent loss or degradation of habitat. Levee protection techniques that result in an impermeable surface or subsurface may result in loss of vegetative cover, loss of retreat sites for listed species, and loss of prey species that support listed species. Installation of impermeable surfaces and subsurface eliminate soil crevices and burrows that provide retreats from predators, retreats from temperature extremes, estivation sites for listed species and prey of listed species (such as tree frogs, bullfrogs, lizards), and also results in a loss of small mammal prey species. Replacement of vegetation with hard structures (e.g., rock riprap) may result in loss of foraging habitat, movement corridors, loss of vegetative cover and subsurface retreat sites, may present barriers to normal movements, and may increase runoff, siltation, and contamination of waterways.

Indirect effects:

Reconstructing levees to a uniform or to increased levels of protection, and to increase levee integrity may preclude restoration actions that are considered necessary for recovery. Reconstruction of existing levees may preclude consideration of setback or cutoff levees that would restore natural hydrologic regimes and processes essential to provide functioning ecosystems upon which listed species depend. Implementation of a levee integrity may also restrict and preclude restoration of habitat in the vicinity of reconstructed levees, contributing to loss of movement corridors and continued fragmentation of habitat.

Indirect effects of levee improvements include alteration of the timing, magnitude, frequency and duration of water flows. Levee integrity improvements to control seepage may change hydrology of surface and ground waters. Increased flood protection may facilitate conversion of habitat to urban or agricultural uses, or may cause conversion to more intensive agricultural uses (i.e., irrigated pasture converted to row crops, vineyards, or orchards).

Indirect effects of bringing levees to the PL 84-99 standard (or other standards with similar effects) include maintenance activities required for eligibility for post-flood Federal disaster assistance. Maintenance activities are intended both to maintain levee integrity and to maintain ease of inspection so that damage such as boils, slumping, erosion, and subsidence can be easily detected. Maintenance activities include road repair, removal of woody vegetation, mowing, burning, discing, grading, herbicide application, and rodent control, including use of burrow fumigants and poison baits. Listed species may be killed or injured during any of these activities. Vegetation control may remove or degrade habitat and result in loss of cover, increased predation, loss of foraging areas, and retreat sites. Removal of vegetation may contribute to erosion, increased runoff, siltation, and contamination of waterways and wetland and aquatic habitats. Removal of vegetation may also alter hydrology by increasing runoff, timing, magnitude, frequency and duration of flows. Continued maintenance and vegetation control may prevent and preclude reestablishment of habitat on or in the vicinity of levees. Maintenance activities may disturb or disrupt essential behavior such as feeding, breeding and sheltering. Individuals may be displaced into unsuitable habitats and may suffer increased risk of mortality due to predation, vehicular strikes, increased inter- and intraspecific competition, disease, and starvation. Non-target species may be killed or injured by use of herbicides and pesticides. Use of herbicides and pesticides may contaminate wetlands or waterways and may result in impaired reproduction, foraging, and sheltering, and increased susceptibility to disease and predation.

In addition to maintenance activities, repairs under the PL 84-99 program, or similar programs, may result in take of listed species. Eligibility for public assistance may increase the frequency, number of sites, and acreage of impact of repair activities. Additional funding may also increase the frequency and amount of repair activities. If disturbance frequency exceeds the recovery rate of the affected species, declines in species numbers, reproduction, and distribution may occur.

Levee repair, improvement, and construction projects could ultimately lead to the listing of many species and could reasonably be expected to reduce the likelihood of survival and recovery of listed and proposed species. However, this should not be the case given the assumptions that: the conservation actions described in the Description of the Proposed Action will be fully implemented, including, but not limited to, the ERP, the Watershed Program, and the MSCS; CALFED agencies will request adequate funding for the conservation programs as necessary to

implement this biological opinion; adaptive management will be used to assess projects and programs and if found to interfere with recovery, the project or program will be modified or terminated; implementation of, and conformance with, all recovery plans will be an integral part of all site-specific consultations; the CALFED Agencies will closely coordinate with the Service during development and implementation of all O&M Plans and Resource Management Plans; any site-specific effects to listed species will be consulted upon following site-specific analysis and prior to the effect, and the Service and the CALFED Agencies are adequately funded and staffed to complete tiered site-specific consultations from this opinion and track implementation of conservation actions.

Water Quality Program

The Water Quality Program is designed to provide good water quality for environmental, agricultural, drinking water, industrial, and recreational beneficial uses, and to achieve continuous improvement in the quality of water of the San Francisco Bay-Delta estuary. The success of the Water Quality Program, however, will depend upon close coordination with other CALFED Programs.

Paired with the Watershed Program, the Water Quality Program would improve overall water quality by reducing the loading of constituents (e.g., heavy metals, pesticides, residues, salts, selenium, pathogens, suspended sediments, temperatures, bromides, and total organic carbon) that enter Delta tributaries from point and non-point sources. Moreover, elements from these two Programs could reduce adverse concentrations of contaminants contained in receiving waters. The long-term impacts of the Watershed Program on water quality are expected to be beneficial. By reducing the mass of pollutants reaching the Delta from tributary streams, the program would improve in-stream water quality and provide benefits to CALFED target species. In-stream water quality would be improved in the Sacramento River and San Joaquin River Regions, and the reduced contaminant load in Delta outflow would benefit species in the Bay Region.

The Water Quality Program would result in general water quality benefits when paired with the Water Use Efficiency Program. The Water Use Efficiency Program provides incentives for water conservation and water recycling. Water use efficiency could reduce diversions from Delta channels and subsequently reduce the loads of contaminants returned to the channels thereby benefitting CALFED target species through reduced entrainment and impingement. Because one of the goals of the Water Use Efficiency Program is to focus on achieving benefits related to flow timing, reduced diversions could aid in the dilution of agricultural tailwater when discharged to a stream.

The Water Transfer Program could affect water quality, positively or negatively, depending on the timing of the water transfer. Water transfers could change river flows and subsequently, water temperatures. In addition, the source of water for a transfer and the timing, magnitude, and pathway of that transfer could affect species positively or negatively, depending on how that transfer occurs. Beneficial water quality impacts from water transfers would occur when the transfer would decrease concentration of contaminants through increased stream flow or through the transfer of water from a higher quality source. Because water transfers have the ability to positively or negatively affect water quality, analysis of water transfers will be evaluated on a case-by-case basis.

Improvements to Delta levees, under the Levee System Integrity Program, would result in short-term adverse effects on water quality during the waterside construction phase of the project. Toxic substances contained in old levees or in channel sediments could be released during levee work or while dredging. However, levee improvements would likely reduce the risk of failure during earthquakes and floods or as a result of gradual structural deterioration. A catastrophic levee failure could result in rapid sea-water intrusion thus increasing salinity in the Delta. This in turn could cause adverse effects to listed species habitats, food base, and behavior.

Surface water storage along with Delta conveyance improvements could adversely effect water quality by increasing turbidity during the construction phase. Excess sediment could be discharged into the various waterways which in turn could cause increased predation on native species or inhibit their ability to successfully forage. The storage of water in surface reservoirs could also adversely affect water quality. As new reservoirs are constructed, previously dry lands would become inundated and trace elements, including mercury, could become mobilized and then released to streams and the Delta. Water stored on Delta islands could increase Total Organic Carbon production. Surface water storage could also adversely affect Delta hydrology. Reservoirs typically are use to store water during abundant spring flows for later use in dry months or years. Thus, spring flows would be reduced or eliminated compared to unimpaired flows, and flow during dry periods would be increased.

However, surface storage could also provide environmental benefits if operated during periods of environmental concern (e.g., during upstream migration periods, when fish are spawning, etc.). Surface water storage could increase flexibility to provide for additional fresh-water releases and Delta inflows that could improve Delta water quality for ecosystem protection. These benefits would be most apparent in dry months and seasons when additional water would be needed to meet environmental needs, such as attraction flows and reduced in-stream temperatures. Upstream storage releases could also augment Delta outflows when needed to control sea-water intrusion and optimize estuarine conditions for the ecosystem and dependent fish species (as

indicated by the position of X2). Because water storage operations would have the ability to positively or negatively affect water quality, each storage facility must be considered on a case-by-case basis.

Overall, the Water Quality Program is designed to reduce the discharge to waterways of contaminants from municipal and industrial wastewater, urban and agricultural runoff, and drainage from abandoned mines. This reduction, in the long-term, would improve water quality in the Bay-Delta system and improve habitat conditions for CALFED target species.

Ecosystem Restoration Program

The ERP is intended to achieve "recovery" or "contribute to recovery" of listed species in the Bay-Delta watershed through the implementation of restoration actions. The ERP identifies over 600 programmatic actions addressing several ecosystem elements that will be implemented throughout the Sacramento-San Joaquin River basin and Bay-Delta. Thus, fish, wildlife, plants, and the ecosystems upon which they depend would benefit from implementation of the ERP in a number of ways.

The ERP would restore and maintain ecological processes and structures that sustain healthy fish, wildlife, and plant populations. In conjunction with other programs such as CVPIA AFRP and the EWA, the ERP would increase the abundance and distribution of desired aquatic species including, but not limited to, delta smelt, Sacramento splittail, and sturgeon. In the first stage of ERP implementation, these aquatic species would begin a trajectory toward recovery from improved and reestablished ecosystem processes, including streamflow, sediment supply, floodplain connectivity, stream temperature, and biological productivity. Restoration of aquatic areas through setback levees and biologically constructed levee fixes would increase species habitat, and new fish screens would reduce entrainment losses. Likewise, the ERP would provide benefits to terrestrial vegetation and wildlife. The ERP would result in net increases in area for target habitat supporting plant and wildlife species, including special-status species. Measures would protect natural habitats from future activities and would reconstruct the historical pattern of habitats in the CALFED Program regions. Major categories of these actions, organized by Ecosystem element, and their effects on listed species are identified below.

The MSCS contains a detailed accounting of both the adverse and beneficial effects of ERP actions on specific species and their habitats. The effects analysis in the MSCS is incorporated into this document by reference.

Water Use Efficiency Program

The Water Use Efficiency Program contains measures designed to manage the use of new and existing water supplies. These include measures to: support ongoing urban and agricultural sector processes for certifying and endorsing local agency implementation of cost-effective efficiency measures; provide technical and planning assistance to local agencies and districts in developing and implementing water use efficiency measures; and, institute a competitive grant/loan incentive program to encourage water use efficiency investments in the urban/industrial and agricultural sectors. The four WUE Program areas include Agricultural Water Conservation, Urban Water Conservation, Water Recycling, and Managed Wetlands. Important linkages exist between the WUE Program and other CALFED programs. Many of these programs, and their effects, are discussed in detail under the respective portions of this opinion. Conversions of native and agricultural habitats and related operations either directly or indirectly facilitated by increases in water supplies made through conservation can include: conversion of native habitats to agricultural use; conversion of agricultural land to more water intensive purposes; conversion of agricultural land to urban use; pesticide application and runoff, and contaminant loading; and, changes in hydrology, water flow timing and structure. These operations have contributed to the loss, degradation or conversion of listed species habitat such as riparian corridors, annual grasslands, certain types of agricultural lands, vernal pools, aquatic and coastal habitats. Most of the other habitats discussed in this opinion have been impacted by water conservation measures to some degree.

Direct effects of agricultural water conservation:

Implementation of the WUE Program may include implementing measures on existing agricultural lands and waterways, such as: lining canals and waterways with concrete or other impermeable surfaces to prevent or decrease seepage and percolation; constructing covered canals or pipelines to prevent evaporative losses; control and removal of vegetation in and adjacent to canals and waterways to decrease loss of water through evapotranspiration; and regrading and leveling of agricultural lands to improve distribution uniformity of irrigation water. Listed species such as the giant garter snake may be killed or injured by heavy equipment during construction activities necessary to line canals, construct pipelines, mechanically remove vegetation, and grade and level agricultural lands. Dewatering during construction results in stranding and mortality of aquatic species. Normal behavior patterns will be disrupted by construction activities, impairing breeding, feeding and sheltering. Listed species may be displaced into unsuitable habitats and may suffer increased risk of vehicular mortality, predation, intra- and interspecific competition, disease, and starvation.

Methods of decreasing losses of water during conveyance may result in loss of natural habitat associated with irrigation and drainage canals, including seasonal and permanent wetlands and riparian vegetation along and adjacent to waterways. Water use efficiency programs for agricultural water uses will result in a reduction of agricultural irrigation and drainage water to support natural habitat areas. Lining or burying canals and waterways and removing vegetation along canals and waterways will result in loss and degradation of habitat, loss of protective cover, foraging areas, retreat sites, and movement corridors. Loss of cover and habitat along waterways may disrupt normal movements and present barriers to dispersal. Increased vegetation control associated with water use efficiency programs results in increased frequency of disturbance of listed species and their habitats. If disturbance frequencies are greater than the recovery rate of the species and/or its habitat, declines in species numbers, reproduction, and distribution may occur. Non-target species, including listed species and their prey, may be killed or injured by use of herbicides and pesticides. Increased use of herbicides and pesticides contributes to bioaccumulation of contaminants throughout the food chain. Use of herbicides and pesticides will contaminate wetlands or waterways and may result in impaired reproduction, foraging, and sheltering, and increased susceptibility to disease and predation. Grading and leveling of land to improve distribution uniformity of irrigation water may result in the loss of permanent and seasonal wetland habitats.

Many species depend to some extent on agricultural lands and the habitat that irrigation and drainage water provide. Due to loss of the majority of native wetland habitats in the Sacramento and San Joaquin Valleys, the federally threatened giant garter snake (*Thamnophis gigas*) is largely dependent on habitat associated with agricultural waterways. Water use efficiency programs could result in significant loss and degradation of giant garter snake habitat. Giant garter snakes use waterways and canals as habitat and as movement corridors but are highly dependent on and associated with vegetative cover for protection from predation and temperature extremes. Agricultural waterways now provide the only movement corridors between some populations of giant garter snakes, as well as the only movement corridors between protected habitat on state and federal wildlife refuges. Loss of habitat along waterways that may result from water use efficiency programs may lead to fragmentation of giant garter snake habitat, isolation of populations, loss of genetic exchange between populations, and potentially to local extinctions of small genetically isolated populations.

Indirect effects of agricultural and urban water conservation:

Agricultural and urban water conservation could indirectly result in conversion of native habitats to irrigated agriculture, or conversion of agricultural lands or native habitats to urban uses. Conversions could be facilitated by: use of groundwater augmented by conserved water via

recharge from the application of conserved water to agricultural land; use of tail water produced from application of conserved water to agricultural land, and use of recycled water on agricultural land produced from application of conserved water to municipal and industrial development. Loss of upland, riparian and wetland habitats may be expected as a result of conversions made possible by increased water availability.

Conversion of habitats may result in: loss of upland refugia near aquatic habitats; altered migration and dispersal patterns of animals; reduced likelihood of seed dispersal across agricultural fields; reduced survival in degraded habitats within and around agricultural operations; reduced water quality; lack of reproductive areas; reduced forage; increased mortality from operations such as mowing and harvesting; and interference with vital behaviors. Additional impacts that will result from conversion to residential use include: increased direct mortality; predation by pets; competitive interactions with domestic animals, and; interruption of vital behaviors through increased light, noise, and increased contact with humans and domestic animals.

The conversion of native habitats to agricultural lands indirectly caused by increased water availability acquired through conservation measures; can increase the acreage of agricultural lands to which insecticides, herbicides, and rodenticides are applied. This can adversely affect listed species by: direct mortality; secondary poisoning of predators and scavengers; degradation of habitat quality following herbicide application; loss of prey base after pesticide application; reduced water quality; impacting native habitat through pesticide and herbicide drift; and loss of pollinators. Conversion of natural habitats and agricultural lands to residential/industrial use will produce similar effects. If an increase in available water allows conversion to irrigated agriculture in areas of poorly drained soils an increase in the effects from agricultural drainwater contamination may be expected, as described above.

Implementation of water efficiency measures may eventually lead to reduced diversions. Fish entrainment may decrease as a result of reduced pumping and diversions. A net reduced demand for water could allow more flexibility in timing, such that diversions could be reduced to minimize entrainment of fish during critical life stages. Water use efficiency programs could also make more water available for instream flows, and improve management of water for managed wetlands. Reduction in agricultural and urban runoff may improve water quality in the Delta and its tributaries and subsequently decrease the effects of contaminants on listed species and their habitats. Improved water efficiency may also reduce the need for other storage and conveyance projects, and thereby avoid the potentially large environmental effects of implementing those programs.

Site-specific information is needed for future implementation of specific measures under the WUE Program, so these actions are not covered by this opinion. However, the following measures are expected to minimize the effects of the WUE Program: project level environmental documentation and review; coordination with the Water Quality Program; coordination with ecosystem improvements; incorporation of techniques to restore, enhance, and protect ecosystem values; and implementation of MSCS measures to avoid, minimize, and compensate take of listed species. These measures, in addition to implementation and coordination with the ERP are expected to have a net benefit to ecosystems and listed species.

Water conservation projects could ultimately lead to the listing of species and could reduce the likelihood of survival and recovery of listed and proposed species. However, this should not be the case given the assumptions that: the conservation actions described in the **Description of the Proposed Action** will be fully implemented, including, but not limited to, the ERP, the Watershed Program, and the MSCS; CALFED agencies will request adequate funding for the conservation programs as necessary to implement this biological opinion; adaptive management will be used to assess projects and programs and if found to interfere with recovery, the project or program will be modified or terminated; CALFED agencies will work closely with water users, providing them with maps of listed species habitats within their Service areas and guiding them through the consultation process to address site-specific effects; CALFED Agencies will encourage the completion of HCPs encompassing the affected areas; implementation of, and conformance with, all recovery plans will be an integral part of all site-specific consultations; the CALFED Agencies will closely coordinate with the Service during development and implementation of all O&M Plans and Resource Management Plans; any site-specific effects to listed species will be consulted upon, as appropriate, following site-specific analysis and prior to the effect, and the Service and the CALFED Agencies are adequately funded and staffed to complete tiered site-specific consultations from this opinion and track implementation of conservation actions.

Water Transfer Program

The Water Transfer Program proposes a framework of actions, policies, and processes that, collectively, will facilitate water transfers and the further development of a Statewide water transfer market. Water transfers may encourage a more efficient use of water. For example, a water transfer based on the temporary fallowing of a particular field may produce revenue that could be used to improve the irrigation systems on that same field when it is brought back into production. The water that is no longer required for irrigation, when the field is fallowed, may be transferred for beneficial use elsewhere. Additionally, water transfers can provide benefits to the ecosystem by establishing a mechanism to 1) move water assets into and out of an EWA, once created, 2) move water from storage facilities (surface or groundwater) to provide in-stream

flows for the environment beyond the minimum requirement as well as provide salinity variability and reduced entrainment and impingement impacts associated with reduced or rescheduled diversions, and 3) provide water quality benefits by augmenting existing in-stream flows during agricultural return flow practices.

However, water transfers can also cause adverse effects to the environment primarily through changes to riverine flow and export. If transfers between agricultural and urban uses are timed differently from "usual" operation or out-of-basin transfers are made, water may not be available for use by fish and wildlife during key feeding or breeding times. This could also result in reduced habitat abundance attributable to reduced flow effects and/or reduced transport and attraction in response to reduced flow effects. Increased entrainment attributable to flow effects on species movement and distribution could also occur. Ground water transfers, or surface water transfers based on groundwater substitution, could result in land subsidence, degradation of groundwater quality, or impacts on vegetation dependent on groundwater.

Decline of habitats and species numbers is expected to continue if water transfers are made without regard to species needs. Degradation of listed species habitats and lack of recovery of affected listed species is expected to result if this consideration is not taken into account..

Poorly-timed water transfers could ultimately lead to the listing of many species and could reasonably be expected to reduce the likelihood of survival and recovery of listed and proposed species. However, this should not be the case given the assumptions that: the conservation actions described in the **Description of the Proposed Action** will be fully implemented, including, but not limited to, the EWA, the ERP, the Watershed Program, and the MSCS; agencies will request adequate funding for the conservation programs as necessary to implement this biological opinion; adaptive management will be used to assess projects and programs and if found to interfere with recovery, the project or program will be modified or terminated; the CALFED Agencies will closely coordinate with the Service during water transfer planning, any site-specific effects to listed species will be consulted upon following site-specific analysis and prior to the effect. The magnitude of transfers not addressed in the OCAP review and resulting from CALFED Program actions will be fully analyzed and addressed under section 7 or section 10 of the ESA, as appropriate.

Watershed Program

The Watershed Program would encompass the entire geographic extent of the CALFED Program. Any actions funded or otherwise guided by the Watershed Program through technical or financial assistance and coordination may impact any of California's biological communities

(Table 1). Actions implemented in association with the Watershed Program has the potential to affect numerous species of animals and plants throughout the geographic area of the CALFED Program, including those evaluated under the MSCS.

If implemented correctly, the Watershed Program may result in minimal adverse effects to fish, wildlife, and plant species. An effective Watershed Program may ultimately be largely beneficial to biotic communities throughout the State of California by funding and providing technical assistance and coordination to promote positive actions and planning efforts within local watersheds to restore and maintain the health and integrity of ecosystems. An effective Watershed Program could minimize habitat fragmentation by supporting carefully designed land-use planning within watersheds. High water quality within watersheds could be another beneficial result of an effective Watershed Program. Restoration projects funded, or otherwise guided, through an effective Watershed Program could provide net benefits to local watersheds and their associated ecosystems. Habitat connectivity could be restored by restoration efforts throughout a watershed, thereby reducing habitat fragmentation and improving ecosystem integrity. An effective watershed program would be largely beneficial to the environment as a whole, though some direct adverse effects, however temporary, would likely result with the implementation of the Watershed Program. Foraging, reproduction, and dispersal of wildlife species inhabiting local watersheds could be disrupted by various watershed projects.

Watershed restoration projects would be largely beneficial in restoring habitat, dispersal corridors, and overall ecosystem function. However, direct adverse effects may be a temporary result of restoration activities. Foraging, reproduction, and dispersal could be disrupted by temporary disturbances like excessive noise during restoration activities (e.g., operation of heavy equipment), alteration of streambed, bank, and floodplain habitat to facilitate restoration, and frequent visual, auditory, and physical disturbances caused by vehicular and human traffic to, from, around, and within restoration areas. Individual species may be harmed or killed by the same disturbances mentioned previously.

Restoration projects within stream channels and adjacent corridors may temporarily result in increased inputs of sediments due to earth moving activities associated with restoration efforts. Aquatic or semi-aquatic species inhabiting stream reaches where sediment loads are increased may experience reproductive failure; siltation/sedimentation could lead to mortality of eggs/larvae of certain species (e.g., California red-legged frog, foothill yellow-legged frog, salmonid fishes, aquatic invertebrates) through suffocation.

Any temporary increases in sediment loads below restoration areas where earth moving activity has occurred may also reduce populations of organisms at the base of the food web, thereby

affecting food availability for primary and higher order consumers utilizing the stream and associated riparian corridor. A reduced availability of food locally may adversely affect the overall fitness of fish and wildlife species, if only temporarily.

Water Management Strategy

Storage

CALFED is currently considering twelve separate surface water storage projects. These actions, especially new surface storage reservoirs, would result in losses of various habitat types. Habitat loss, alteration, and fragmentation caused by surface storage actions throughout the geographic area of the CALFED Program would likely adversely affect species of animals and plants, including those evaluated under the MSCS.

New reservoirs would transform biotic communities within watersheds, both downstream and upstream of dams. Streams that were once naturally/historically intermittent (dry for part of the year) are converted to perennial streams below dams which eliminates species adapted to an intermittent hydrological regime. New reservoirs also typically introduce both native and non-native species into watersheds where they did not occur previously. Introductions of non-native species (e.g., bullfrogs, centrarchid fishes, ictalurid fishes, salmonid fishes) can have catastrophic effects on local populations of native species due to competition, predation, or introduced diseases.

Expanding the capacity of existing reservoirs results in additional loss of natural habitat upstream of dams, increases fragmentation of habitat, and increases the extent of impassable barriers to movement and dispersal of native land-dwelling species not capable of flight. Even species capable of swimming (e.g., many invertebrates, reptiles, amphibians, and some mammals) are usually incapable of crossing large bodies of water (i.e., reservoirs). The presence of non-native predators found in most, if not all, reservoirs only adds to the effectiveness of reservoirs as barriers to movement and dispersal. Ultimately, habitat fragmentation and the introduction of non-native species can create barriers to gene flow which can threaten the long-term viability of local populations of native species of both animals and plants.

New reservoirs, and at least some reservoir enlargements, would be accompanied by the installation of conveyance conduits to facilitate water transfers. The construction of conveyance structures would lead to additional losses, alterations, and fragmentation of habitat. Conveyance structures, particularly open-water canals, constitute impassable barriers to movement and dispersal for the vast majority of species incapable of flight. The potential effects of conveyance

structures are discussed in the effects section addressing the Conveyance element of the CALFED Program.

Ultimately, new and expanded surface water storage facilities could result in significant increases in both the rate and extent of growth/development throughout localities/regions benefitting from an effective increase in water supply.

In addition, reoperation of existing hydropower facilities for the primary purpose of water supply could result in changes in the timing and magnitude of flows downstream of the facilities. Thus, effects associated with new or expanded surface reservoirs also apply to these facilities. In addition, effects associated with any changed service areas may include land conversions (as described earlier in the document), including in modifications to the area of origin.

Specific effects of five of the twelve actions currently under consideration by CALFED Agencies, Los Vaqueros Reservoir Enlargement, Shasta Reservoir Enlargement, Millerton Reservoir Enlargement, Sites Reservoir, and Delta Wetlands (new reservoirs), are discussed qualitatively below. Because project-specific information is unavailable to quantitatively evaluate the effects of these actions, project-specific section 7 consultation is required for all storage projects and their associated effects.

A) Los Vaqueros Reservoir Enlargement (Contra Costa County)

Los Vaqueros Reservoir, an off-stream reservoir with a storage capacity of 100 TAF, may be enlarged by up to 400 TAF. An expanded Los Vaqueros Reservoir could result in the loss of as much as 3,340 acres of grasslands, woodlands, and riparian habitat, including mitigation land associated with the reservoir which was established to minimize adverse effects to the California red-legged frog (*Rana aurora draytonii*), San Joaquin kit fox (*Volpes macrotis mutica*), and Alameda whipsnake (*Masticophis lateralis euryxanthus*). The potential effects of expansion of Los Vaqueros Reservoir are currently being evaluated. Concerns regarding expansion of this reservoir include: (a) expansion could threaten the viability of the local population of California red-legged frogs that depend on the mitigation area and remaining habitat around the reservoir for survival; (b) viability of San Joaquin kit foxes (*Vulpes macrotis mutica*) could also be threatened by an expanded Los Vaqueros Reservoir due to additional habitat loss and fragmentation, and potential elimination of a corridor between the northern and southern kit fox range; (c) enlargement of Los Vaqueros could result in impacts to other species as well, including those evaluated under the MSCS [e.g., California tiger salamander (*Ambystoma tigrinum californiense*)].

An enlargement of Los Vaqueros Reservoir may be followed by proposals for interconnections (conveyances) between Los Vaqueros and Mokelumne River, Hetch Hetchy Reservoir, or South Bay Aqueducts to store and distribute water from a variety of sources throughout the Bay Area. Reservoir interconnections would require new conveyance structures, which would result in multiple effects along and adjacent to conveyance corridors. As described above, installation of conveyance structures leads to loss, alteration, and fragmentation of all habitats traversed by the conveyance structures. Conveyance structures can be impassable barriers to movement and dispersal of both plant and animal species, including threatened and endangered species and those evaluated under the MSCS [e.g., San Joaquin kit fox and Alameda]. Ultimately, barriers to dispersal can inhibit gene flow within and between populations of plants and animals, which can be detrimental to the long-term viability of affected populations.

B) Shasta Reservoir Enlargement (Shasta County)

By raising Shasta Dam by as much as 6.5 feet in elevation (an approximate 300 TAF increase in storage capacity), at least 2,000 acres of habitat would be lost due to inundation. A portion of the McCloud River (protected under California State law) would be lost. All species inhabiting the 2,000 acres of habitat would be displaced, thereby intensifying inter-specific and intra-specific competition for resources locally. Mountain yellow-legged frogs (*Rana boylii*), and possibly tailed frogs (*Ascaphus truei*) could be directly affected due to habitat loss. Frogs upstream of the expanded reservoir could be adversely affected by non-native species (e.g., bullfrogs). Other animal and plant species may also be adversely affected by an enlarged reservoir due to habitat loss and fragmentation. Any enlargement of Shasta Reservoir would likely reduce the abundance and distribution of the Shasta sideband snail (*Monadenia troglodytes*), Shasta clarkia (*Clarkia borealis* spp. *arida*), and Shasta snow-wreath (*Neviusia cliftonii*).

When used to augment flows in the lower Sacramento River in the appropriate seasons, water stored in Shasta Reservoir may benefit aquatic species downstream (e.g., threatened and endangered fishes). An expanded Shasta Reservoir could also provide additional water for such environmental purposes.

C) Millerton Reservoir Enlargement

Millerton Reservoir, located on the San Joaquin River near Fresno, California, may be enlarged to a capacity of 1,240 TAF. An enlarged Millerton Reservoir may improve water-supply reliability and enhance flexibility to maintain instream flows and water quality in the San Joaquin River downstream of Friant Dam. The proposed enlargement may also improve the ability to manage San Joaquin Valley conjunctive use operations, regional water transfers, and flood control.

Approximately 3,500 acres of natural habitat would be lost as a result of reservoir enlargement. Numerous plant and animal species could be affected by an enlargement of Millerton Reservoir, including those evaluated under the MSCS.

D) Sites Reservoir

The establishment of the proposed Sites Reservoir, a new off-stream storage reservoir with a proposed storage capacity of 1.8 MAF, would result in the loss of at least 900 acres of oak-woodland and 70 acres of potential habitat for federally listed vernal pool crustaceans [i.e., vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardi*)]. In addition to impacts to vernal pool crustaceans, Sites Reservoir may negatively affect other species of animals and plants, including those evaluated under the MSCS [e.g., California Red-legged frog (*Rana aurora draytonii*), western spade-foot toad (*Schaphiopus hammondii*), California tiger salamander (*Ambystoma tigrinum californiense*), and adobe lily (*Fritillaria pluriflora*)].

As stated above, new reservoirs can completely transform biotic communities within watersheds, both below and above dams. Streams that were once naturally/historically intermittent (dry for part of the year) are typically converted to perennial streams below dams (through surface or ground water input) which eliminates species adapted to an intermittent hydrological regime. New reservoirs also can introduce both native and non-native species into watersheds where they did not occur previously. Introductions of non-native species (e.g., bullfrogs, centrarchid fishes, ictalurid fishes, salmonid fishes) can have catastrophic effects on local populations of native species due to competition, predation, or introduced diseases.

The seven remaining off-stream reservoirs being considered have been deferred, but may be revisited in the future, beyond Stage 1 of the CALFED Program. Montgomery Reservoir will be evaluated as an off-stream reservoir alternative to the proposed Millerton Reservoir enlargement. Schoenfield and Thomes-Newville Reservoirs, and the proposed Colusa Reservoir Complex could be evaluated later as an alternatives to the proposed Sites Reservoir. Currently, information is inadequate at this time to conduct any meaningful analyses of effects for any of the deferred reservoir projects mentioned above. However, the general effects for new surface reservoirs described above would be expected to result from any of these projects, should they be implemented in the future. Although the proposed Ingram Canyon Reservoir is to be deferred as well, an initial effects analysis specific to the proposed Ingram Canyon Reservoir is provided below.

Although deferred from Stage 1 of the CALFED Program, CALFED Agencies are conducting estimates of costs, benefits, and impacts of the proposed Ingram Canyon Reservoir. This new

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reservoir, if approved, would be located south of the Delta in Ingram Canyon, Stanislaus County (approximately two miles west of the California Aqueduct and 32 miles south of Banks Pumping Plant). The proposed Ingram Canyon Reservoir would have a holding capacity of 820 TAF, and would function similarly to the existing San Luis Reservoir to add flexibility to Delta export operations under optimal biological and water quality conditions.

At least 3,500 acres of grassland, oak savanna, oak woodland, and chaparral habitat would be lost. In addition, at least 5 miles of intermittent stream would be lost due to inundation. All species of plants and animals living within the 3,500 acres to be inundated and intermittent stream would be adversely impacted by the proposed Ingram Canyon Reservoir, including those species evaluated under the MSCS [e.g., California red-legged frog, California tiger salamander, western spadefoot toad (*Scaphiopus hammondii*)]. The long-term viability of the San Joaquin kit fox could be threatened by the proposed reservoir through direct habitat loss, habitat fragmentation, and by the occlusion of an essential dispersal corridor maintaining gene flow between fox populations to the north and south of the proposed reservoir site.

F) Delta Wetlands

The Delta Wetlands proposal consists of converting two Delta islands comprising 11,000 acres, Webb Tract and Bacon Island, into surface storage facilities (reservoirs) and restoring two islands, Bouldin Island and Holland Tract, comprising roughly 9,000 acres to natural habitat. Together the two new reservoirs would provide approximately 250 TAF of water storage capacity. These new reservoirs are expected to improve flexibility in managing Delta fishes and water quality problems. Any modifications to the project description for this facility as described in our current biological opinion (File 1-1-97-F-76, May 6, 1997) would require revised consultation under section 7 of the ESA.

Restoring 9,000 acres across two Delta islands to natural habitat would likely benefit some plant and animal species living in the Delta that require natural riparian woodland and other natural habitat types for survival. The proposed reservoirs may provide habitat for migrating and some resident waterfowl.

However, the potential quality of water stored over peat soils underlying Delta islands has not been evaluated sufficiently. Conditions may arise in the proposed reservoirs, once constructed and filled, where microbial decomposition of the peat soils comprising the reservoir bottoms could result in highly nutrient-rich reservoir water. This nutrient rich water would not be appropriate for municipal uses. Furthermore, such nutrient rich water may be potentially detrimental if used to supplement Delta flows, since nutrient rich water could significantly increase the biological

oxygen demand where added to the Delta, thereby resulting in anoxic conditions within the water column. Anoxia within the water column can adversely affect and kill any aquatic organisms which respire aerobically.

G) Groundwater Conjunctive Use and Groundwater Storage

The CALFED Program has currently identified/proposed a target groundwater storage capacity of 500 TAF to one MAF south of the Delta to be implemented during Stage 1. The CALFED is currently evaluating the potential of groundwater conjunctive use/groundwater banking projects in all major groundwater basins within the CALFED solution area. Although the proposed groundwater conjunctive use/storage program has the potential to impart beneficial effects on the environment and plant and animal species within the geographic area of the CALFED Program, adverse effects also may occur.

Groundwater aquifers have the potential to be augmented with out-of-basin water with likely effects occurring within the watershed of origin. Donor streams may experience reduced flows due to water being siphoned off to distant aquifers in other watersheds. Reduced flows in streams can have effects on water quality, water temperature, riparian vegetation, and instream habitat. All species of plants and animals that utilize the affected riparian corridor for all or part of their lives may be adversely impacted by reduced stream flows. In addition, diverting water from a donor stream/watershed results in a net loss of water from the local watershed and groundwater aquifer. This net loss of water must be replaced by precipitation and, potentially, acquisition of water from distant donor streams/watersheds/aquifers.

Conveyance

The CALFED Program strategy is to develop a through-Delta conveyance alternative based on existing Delta configuration with some modifications, evaluate its effectiveness, and add additional conveyance and/or water management actions if necessary. The modifications to the existing Delta configuration will occur in both the south and north Delta. Specific effects of the through-Delta conveyance alternative under consideration by CALFED Agencies, is discussed qualitatively in the following sections. Because project-specific information is unavailable to quantitatively evaluate the effects of these actions, project-specific section 7 consultation is required for all CALFED conveyance projects and their associated effects.

The south Delta improvements proposed as part of the "Conveyance Program", excluding the ecosystem restoration components, have been considered in previous biological opinions by the Service (1-1-96-F-53 and 1-1-97-F-184). The draft biological opinion issued by the Service

concluded that the previously proposed Interim South Delta Program would jeopardize the continued existence of the delta smelt and the Sacramento splittail and destroy or adversely modify delta smelt critical habitat. The determination was based upon the project as it was described, and was as follows.

The Service reached the conclusion that reproduction, numbers, and distribution of listed species would be adversely affected by: increasing entrainment of all life stages of listed fish species through un-screened agricultural diversions in the south Delta and through the currently unscreened or newly constructed unscreened intake structures at Clifton Court Forebay as maximum pumping rates in the south Delta are incrementally increased from current limits up to 8,500 cfs initially, and ultimately up to 10,300 cfs; flows toward the south Delta are facilitated through the dredging of Old River to increase its cross-section; and inflow into Clifton Court Forebay is increased. These actions have the effect of increasing the indirect effects of predation upon completion of the new intake structure; and decreasing spawning and rearing habitat as construction modifies the Delta.

The Service reached the conclusion that implementation of approved recovery plan tasks aimed at enhancing aquatic habitat, reducing entrainment losses at water diversions, reducing in-channel dredging, reducing contaminant loading, reducing the effects of introduced species, and reducing the use of traditional levee maintenance practices would be precluded.

The Service reached the conclusion that the constituent elements of delta smelt critical habitat would be adversely modified or destroyed by: adversely affecting over five miles of the physical habitat essential to the species, increasing contaminant loading in Old River through dredging, modifying Delta hydrology and river flow, increasing water velocities, modifying salinities in the form of incremental upstream shifts in X2 placement, and indirectly affecting water quality in the San Joaquin River. These modifications to the constituent elements of delta smelt critical habitat would adversely affect adult migration and spawning, larval and juvenile transport, and rearing.

After these biological opinions were drafted, the CALFED Agencies defined actions that could be taken to improve overall ecosystem health in the south Delta while allowing south Delta facility improvements to move forward. This resulted in a series of proposed actions to improve and elevate the environmental baseline for listed species and move them toward recovery.

These proposed actions include: 1) regional ERP actions, 2) consolidation and screening of agricultural diversions, 3) implementation of the VAMP with subsequent export and flow targets, 4) construction and evaluation of a 500 cubic feet per second (cfs) test facility at the Tracy Pumping Plant to develop best available technology for fish screening and salvage for the intakes

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to the SWP and CVP export facilities, 5) construction of a new screened intake for Clifton Court Forebay for the full export capacity of the SWP (10,300 cfs), 6) evaluation of the need to retain a separate CVP intake facility with interties to the SWP or to consolidate with the SWP facility, 7) increase SWP pumping by 500 cfs from July through September so exports could be reduced during the preceding February through June period, 8) formation of a Barrier Operations Coordination Team to operate the barriers, 9) implementation of mitigation actions to off-set the direct and indirect project effects, and 10) implementation of the Environmental Water Account.

The proposed North Delta Improvements are designed to address flood control, water quality, fish, and water supply reliability. Actions include modification of the Delta Cross Channel gates, channel dredging and/or setback levees in the Mokelumne River, and the creation of additional floodplain, wildlife, and fish habitat. Under the Preferred Program, north Delta improvements also include the study and evaluation of a screened diversion facility on the Sacramento River with a range of diversion capacities up to 4,000 cfs. This diversion facility between the Sacramento and Mokelumne rivers would likely include a fish screen, pumps, and facilities for upstream fish passage.

Under the Preferred Program Alternative, the DCC may be closed from September through July and possibly all months, which could increase delta smelt and splittail survival during January through July compared to DCC operation at the present. However, the additional closure of the DCC relative to present operation may increase the frequency and magnitude of net reverse flow conditions in the lower San Joaquin River.

Construction and operation of a screened diversion facility on the Sacramento River may be pursued during Stage 1 if the evaluations demonstrate that this facility is necessary to address drinking water quality concerns and it can be constructed without adversely affecting fish populations. The fish screens would be designed to prevent adult fish from leaving the Sacramento River and entering the new channel with the flow diverted into the Mokelumne River. Although the fish screen facility would mitigate potential entrainment impacts, other potential adverse effects would have to be addressed prior to constructing this diversion. Existing relationships indicate that reduced flow in the Sacramento River (from flow exiting through the diversion) would cause an increase in the proportion of flow entering Georgiana Slough. USFWS studies indicate that the survival of fish following the Sacramento River route toward Rio Vista may be several times higher than survival of fish entering the DCC and Georgiana Slough. The actual magnitude of survival, however, is uncertain and depends on other factors, including water temperature and flow or salinity. In addition, abrasion, increased predation, impingement on fish screens or other diversion structures, stress from being handled, and movement to inappropriate habitat would reduce the survival of fish contacting the fish screens.

The diversion of additional Sacramento River water into the Mokelumne River channels and the central Delta would increase the frequency and magnitude of natural channel net flow direction in the Lower San Joaquin River, but reduce the magnitude of natural net channel flow in the Sacramento River below the diversion, primarily during February to June. Natural net flow conditions in the Lower San Joaquin River channel could increase productivity, enhance species movement, and reduce entrainment in Delta diversions. The effects of reduced flow in the Sacramento River below the diversion could adversely affect habitat

Dredging to enlarge the Mokelumne River would increase the channel depth and further alter the natural structural features. In the short term, dredging would remove benthic communities and mobilize fine sediments. Maintenance dredging may be required over the long term, resulting in periodic short-term impacts. Dredging also may cause levee instability, which could require additional revetment and levee maintenance activities. Impacts to native fish may be avoided or minimized through the use of accepted construction time windows and best management practices (see *Levee System Integrity Program*). These activities would require further consultation with appropriate fishery agencies. If channel enlargement is the result of setting back existing levees, fish habitat would potentially be increased. Installation of setback levees will be completed in coordination with the ERP (see *Summary of Key Planned Actions* and *Ecosystem Restoration Program*).

Implementing operational changes to the Delta Cross Channel has the potential to benefit native fish migration by keeping species in the main stem Sacramento River thus allowing them to reach preferred habitat areas. Resolving local flood concerns through levee setbacks has the potential to create additional riparian habitats and tidal wetlands thus allowing increased spawning, rearing and refugia habitats for target species. Improving existing levees and dredging channels in the north Delta, especially the channels of the lower Mokelumne River system, may also increase essential species habitat if soft fixes are used and work is performed within specified work windows.

Through increase in conveyance capability and modification of Delta hydrodynamics, decline of habitats and species numbers is expected to continue if north and south Delta improvements are made without regard to species needs. Degradation of listed species habitats and lack of recovery of affected listed species is expected to result if this consideration is not taken into account.

North and south Delta facility improvements examined in isolation could reasonably be expected to reduce the likelihood of survival and recovery of listed and proposed species. However, this should not be the case given the assumptions that: the conservation actions described in the Description of Proposed Actions will be fully implemented, including, but not limited to, the ERP,

the EWA, the Watershed Program, and the MSCS; CALFED Agencies will receive adequate funding for the conservation programs as necessary to implement this biological opinion; adaptive management will be used to assess projects and programs and if found to interfere with recovery, the project or program will be modified or terminated; the CALFED Agencies will closely coordinate with the Service during water transfers; and, project-specific effects to listed species will be consulted upon following project-specific analysis and prior to the effect.

Additionally, the U.S. Fish and Wildlife Service assumes that the beneficial environmental actions will be implemented ahead of the south Delta facility improvements. The milestones included within this document are integral to successful implementation of beneficial actions. The Service understands that not all beneficial environmental actions will be implemented prior to all facility actions coming on line, but assumes that enough beneficial environmental actions will be implemented to raise the environmental baseline before facility actions become operational.

Environmental Water Account

The EWA is designed to provide fishery benefits without additional adverse effects on water deliveries to south-of-Delta contractors. The EWA supplements the existing environmental baseline (1995 Water Quality Control Plan; biological opinions for delta smelt, splittail, and winter-run chinook salmon, CVPIA sources of water including 800,000 acre-feet of (b)(2)). It can augment instream flows, delta outflows and hydrodynamics, and export curtailments to enhance environmental conditions or reduce take at key times of fishery concern. Benefits would be provided to all anadromous and native fishes which use the Delta and its watershed.

Part of the purpose of the EWA is to provide export reductions which would (a) reduce take or enhance environmental conditions, (b) minimize adverse effects of project operations at the State and Federal export facilities, and (c) enhance conditions for fish. The EWA provides an alternative to prescriptive standards that would be applied during periods of exceeding incidental take. The ability of the EWA to provide for additional fishery benefits over the pre-CALFED Program environmental baseline will depend upon the degree to which it must be used to reduce take. Implementation of the EWA will provide a benefit to fish. Tier 3 assets are assumed to be available and will be obtained to reduce take for fish when needed and as described below.

The EWA works on a principle of "no harm" to south of Delta deliveries, which means that the EWA essentially changes the *timing* of exports but does not change the overall magnitude or timing of deliveries.

The EWA is currently designed to be implemented for four years. The program may be continued if the benefits for fish occur and an evaluation of the sufficiency of assets is determined to be adequate. If new water storage and conveyance projects come online, additional fishery impacts are likely to occur through modification of the timing and quantities of water passing through the Delta watershed. To offset potential impacts and to provide for recovery of fish populations, additional operational rules will need to be developed which would allow for protection of fish. These operational rules may include either (a) new standards which limit the timing and magnitude of exports and water supply releases at key periods of concern for fish, (b) new sharing formulae to increase EWA assets, which would allow the EWA to offset impacts and implement restoration actions, or (c) a combination of the two.

If the EWA is not fully implemented, project operations will return to the regulatory baseline. In addition, the following clarifications are set forth: 1) CVP/SWP will implement both the flow and export provisions of either VAMP or, in the absence of VAMP, the flows and export curtailments in the 1995 biological opinion on OCAP; 2) if or when the yellow light level in the incidental take statement is reached, as identified in the1995 OCAP biological opinion, the CVP/SWP will immediately reinitiate consultation and implement actions to reduce the amount or extent of take and reduce the indirect effects of project operations on fish as deemed necessary by the fishery resource agencies; 3) all new projects which may affect the environmental baseline identified in this opinion and the 1995 OCAP opinion will be subject to section 7 consultation to avoid and/or minimize the affects of those actions; and 4) other necessary regulatory provisions which may be required to meet the needs of listed species.

Science Program

The Science Program will largely benefit listed species through implementation of the CMARP. CMARP will support monitoring and research presently not available for many species and their habitats, and will monitor implementation and progress of other CALFED Programs. Through monitoring, research, and assessment of species and program implementation, CMARP is expected to contribute information and recommendations to CALFED Agencies and stakeholders in support of the adaptive management process. Information developed by the Science Program will contribute to the recovery of listed and proposed species.

The Science Program is likely to result in capture, harassment, injury, death, and collection of listed species. These effects will occur during monitoring as part of implementing other CALFED Programs, during baseline monitoring of species populations, and as a part of conducting research projects. The potential effects of Science Program activities will be avoided and minimized by authorizing only qualified biologists to capture and handle listed species while conducting monitoring and research. To achieve this, these activities will be authorized only through the Section 10(a)(1)(A) Recovery Permitting process, or through subsequent, tiered, section 7 biological opinions, which will incorporate the same standards as the Recovery Permitting process.

Multi-Species Conservation Strategy

The MSCS encompasses all CALFED Program elements and strategies and is the guiding document for species conservation throughout Phase III. Its implementation is expected to greatly benefit listed, proposed, and other species. In the MSCS, delta smelt, Sacramento splittail, Lange's metalmark, valley elderberry longhorn beetle, Suisun thistle, soft bird's-beak, Contra Costa wallflower, and Antioch Dunes evening-primrose have been assigned the conservation goal of recovery ("R"); and the San Joaquin Valley woodrat, riparian brush rabbit, salt marsh harvest mouse, California clapper rail, least Bell's vireo, giant garter snake, Delta green ground beetle, and western yellow-billed cuckoo, have been assigned the conservation goal, "contribute to recovery ("r"). The MSCS also describes how goals will be achieved through species prescriptions, which describe the future expected changes in evaluated species' habitats and populations with full implementation of the CALFED Program. If evaluated species prescriptions are achieved, CALFED Program goals for evaluated species will have been met. The CALFED Program is expected to undertake all or most of the actions necessary to recover delta smelt, Sacramento splittail, Lange's metalmark, valley elderberry longhorn beetle, Suisun thistle, soft bird's-beak, Contra Costa wallflower, and Antioch Dunes evening-primrose. The CALFED Program is expected to undertake all or most of the actions in the MSCS focus area

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necessary to contribute to the recovery of San Joaquin Valley woodrat, riparian brush rabbit, salt marsh harvest mouse, California clapper rail, least Bell's vireo, giant garter snake, Delta green ground beetle, and western yellow-billed cuckoo. For other listed and proposed species, the CALFED Program is expected to avoid, minimize, and compensate for the adverse effects of its actions.

The MSCS contains two types of conservation measures: (1) measures to avoid, minimize, and compensate for the adverse effects to evaluated species caused by individual CALFED Program actions, and (2) measures to enhance evaluated species that are not directly linked to CALFED's adverse effects, are consistent with the ERP, and may be milestones. Both types of measures will be implemented through the use of ASIPs that will be developed for specific CALFED Program actions or bundles of actions. The MSCS also allows for additional, project-specific conservation measures to be included in ASIPs. Thus, the MSCS will contribute to avoiding, minimizing, and compensating for adverse impacts to listed and proposed species associated with other CALFED Programs.

Implementation of the MSCS could adversely impact listed species through implementation of conservation requirements. Habitat disturbance and conversion could occur during ecosystem restoration actions (e.g., construction of tidal channels in existing tidal marshes, or conversion of diked, marshes to tidal marsh may temporarily impact salt marsh harvest mice but is ultimately expected to lead to recovery). In addition, individual animals could be harassed during construction, implementation of minimization measures such as capture and relocation of individuals, and capture and handling during monitoring. These types of effects will be avoided and minimized by incorporating measures in the MSCS into ASIPs developed to implement conservation actions.

Implementation Plan

Cumulative Effects

Cumulative effects are those effects of future State, local, or private actions on endangered and threatened species or critical habitat that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action (e.g., non-CALFED Agency projects such as Corps flood control projects, and USFS or BLM actions) are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Numerous non-Federal actions continue to eliminate habitat for listed and proposed threatened and endangered species in the Central Valley and Delta. Habitat loss and degradation affecting both animals and plants continues as a result of urbanization, oil and gas development, road and utility right-of-way management, flood control projects, overgrazing by livestock, and continuing agricultural expansion. Listed and proposed animal species are also affected by poisoning, shooting, increased predation associated with human development, and reduction of food resources. Continued growth and development are also likely effects. Cumulative effects associated with continued growth and development will likely adversely affect federally listed threatened and endangered species throughout the State of California.

In this section, a general description of the adverse impacts to habitats described in the Environmental Baseline section of this opinion are characterized. The habitat sections that follow describe in more detail how activities and events, many of which constitute non-Federal actions, are impacting listed species.

Cumulative Effects to Habitats

Delta Aquatic Habitats

Delta fishes continue to be adversely affected by entrainment, upstream or reverse flows of waters in the Delta and San Joaquin River, destruction of spawning and refugial areas, change in the hydrologic patterns in Delta waterways, and constriction of low salinity habitat to deep-water river channels of the interior Delta (Moyle et al. 1992). Reduced or reversed flows due to pumping can confuse migrating fishes and lengthen out-migration periods. Pumping activities can concentrate Delta fishes and their predators in small areas where predation risk is increased. Fish can be killed by impingement on screening facilities at high flow rates, entrained through pumping plants, and diverted into unsuitable habitat. Reduction in food supply due to water diversions can also cause increased mortality. Water diversions contributing to these cumulative effects include intakes serving non-Federal pumping plants, municipal and industrial uses, water for power plants, and numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay. Levee maintenance disturbs spawning and rearing habitat, and re-suspends contaminants into these waters.

Cumulative effects on the delta smelt and Sacramento splittail include any continuing or future non-Federal diversions of water that may entrain adult or larval fish or that may decrease outflows incrementally, thus shifting the position of these fish species preferred habitat upstream. Water diversions through intakes serving numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay contribute to these cumulative effects. These

diversions also include municipal and industrial uses, as well as providing water for power plants. Delta smelt adults seek shallow, tidally influenced, fresh water (i.e., less than 2 ppt salinity) backwater sloughs and edgewaters for spawning. To assure egg hatching and larval viability, spawning areas also must provide suitable water quality (i.e., low concentrations of contaminants) and substrates for egg attachment (e.g., submerged tree roots, branches, emergent vegetation). Levee maintenance disturbs spawning and rearing habitat, and re-suspends contaminants into these waters.

The introduction and spread of non-native species may occur when the levees are breached or when separate creeks or river systems are reconnected. Several non-native species may adversely affect the delta smelt and splittail, including the Asian clam and three non-native species of euryhaline copepods. The Asian clam could potentially play an important role in affecting phytoplankton population dynamics. The non-native copepods may displace native species and at least one species of copepod (*Sinocalanus doerri*) is difficult for larval fishes to catch because of its fast swimming and effective escape response. Reduced feeding efficiency and ingestion rates weaken and slow the growth of young fish and make them more vulnerable to starvation and predation.

Other cumulative effects include: wave action in channels caused by boats that can degrade riparian and wetland habitat and erode banks; the dumping of domestic and industrial garbage, presenting hazards to the fish because they could become trapped in the debris, injure themselves, or ingest the debris; reduction of habitat, and introduction of pesticides and herbicides from the construction and operation of new and existing golf courses; oil and gas development and production remove habitat and may introduce pollutants into the Napa River; agricultural uses protected by levees reduce riparian and wetland habitats; residential or agricultural land use can fragment and reduce wildlife habitat and corridors; unscreened agricultural diversions throughout the delta divert all life stages of fish (Service 1996); and grazing activities may degrade or reduce suitable habitat.

Additional cumulative effects result from the impacts of point and non-point source chemical contaminant discharges. These contaminants include selenium and numerous pesticides and herbicides associated with discharges related to agricultural and urban activities. Implicated as potential sources of mortality for delta smelt and Sacramento splittail, these contaminants may adversely affect delta smelt and Sacramento splittail reproductive success and survival rates. Spawning habitat may also be affected if submersed aquatic plants used as substrates for egg attachment are lost due to toxic substances.

Salt Marsh Habitats

Pollution, over-exploitation of commercial fisheries, water diversions, and introduction of numerous non-native species continue to affect the ecology of San Francisco Bay tidal marshes. A number of factors influencing the remaining tidal marshes limit their habitat value. Much of the East Bay shoreline from San Leandro to Calaveras Point is rapidly eroding. Many marshes around South San Francisco Bay are undergoing vegetational changes because of land subsidence caused by groundwater pumping. In addition, an estimated 600 acres of former salt marsh along Coyote Creek, Alviso Slough, and Guadalupe Slough are currently dominated by fresh- and brackish-water vegetation due to continuing freshwater discharge from South Bay wastewater facilities and are thus of lower quality for California clapper rails and salt marsh harvest mice. In San Pablo and Suisun Bays, the average salinities are increased by upstream diversions by CALFED and DWR water projects. Intertidal and riparian marsh habitats used by species such as the California clapper rail, salt marsh harvest mouse, and Suisun thistle may be degraded or destroyed by a variety of development and maintenance activities conducted by private organizations, state agencies, or local governments.

Riparian Habitats

Factors contributing to the loss of riparian forest include: (1) continued conversion of non-irrigated land to agriculture; (2) levee construction and maintenance; (3) bank erosion; (4) grazing by livestock; (5) use of riprap for bank protection; (6) groundwater extraction; (7) flow regulation; and (8) the continuing development of land along the riparian corridor. Dams flood riparian vegetation in their impoundments and degrade it downstream by altering flows and geomorphic processes. Flood control interferes with natural processes that affect riparian forest regeneration. Controlled water release from dams reduces mid-successional habitat (dominated by brush and young to middle-aged trees). Unusually heavy or extended flooding of remnant riparian habitats can be detrimental to some terrestrial endangered species (e.g., riparian brush rabbits could drown or be isolated in small upland refugia where they would be more vulnerable to predation; giant garter snakes dormant in burrows could drown or be forced to seek new hibernacula).

Freshwater Wetland Habitats

These wetlands continue to be drained for agricultural and urban use. Some wetlands may also be inundated by reservoirs and converted to open water habitat. Conversion of natural habitats to agricultural and urban uses results in loss of marshes, sloughs, ponds, and small streams. Many of the remaining wetlands may be converted from seasonally to permanently inundated systems.

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Habitat value of some man-made wetlands (rice fields, canals, reservoirs) is adversely affected by maintenance activities, pesticide use, and contaminant loading.

Vernal Pools

Activities that contribute to vernal pool habitat losses include plowing and deep-ripping for agriculture, energy development, urban development, flood control projects, highway and utility projects, and overgrazing (California Department of Fish and Game 1992; 58 **FR** 41700; 59 **FR** 48136). Limited distributional patterns increase the susceptibility of individual populations and entire species to severe declines from both natural and human-induced disturbances. Much of the remaining vernal pool habitat continues to be degraded by fragmentation, changes in hydrological patterns, off-road vehicle use, increased competition from non-native species, periodic drought, and miscellaneous human disturbances. In many areas, the cumulative effects of habitat loss, fragmentation, and degradation reduce the potential for remaining habitats to indefinitely sustain viable populations of rare species. Some vernal pool complexes are protected from disturbance, but the majority remain under pressure from development, and are threatened by activities such as agricultural and urban development, mosquito abatement, gravel mining, flood control and water conveyance projects, pipeline projects, reservoir construction, off-road vehicle use, intensive livestock grazing, refuse disposal, and other activities (59 **FR** 48136). Listed plant species endemic to vernal pool habitats are adapted to hydro-periods with winter inundation and summer drying, and are out-competed by marsh plants when hydrology is altered so standing water is permanently present.

Coastal and Inland Dune Habitats

Continued recreational use of beaches causes disturbance to nesting snowy plovers and least terns from pets, beachcombers, and off-road vehicles. Dune habitats on coastal beaches continue to be altered by the introduction of invasive dune-stabilizing vegetation (especially European beach grass (*Ammophila arenaria*) and ice-plant (*Carpobrotus edulis*). Non-native dune-stabilizing vegetation competes for space with native dune plants and stabilizes open sand faces needed by native dune plants.

Lagoon habitats are altered by upstream water diversions, dredging, and associated changes in salinity, pollution, and siltation. During drought periods, the lack of rainfall, combined with human induced water reductions (i.e., diversions of water from streams, excessive groundwater withdrawals), degrades lagoon ecosystems and creates extremely stressful conditions for most aquatic species. The introduced yellowfin goby (*Acanthogobius flavimanus*) may also compete with the tidewater goby in lagoon habitats.

Ongoing threats to listed species at the Antioch Dunes include competition from weedy species, disturbance from fuel break maintenance and people walking to the riverfront, and ecological changes resulting from severe reduction, fragmentation, and degradation of the dune ecosystem (U.S. Fish and Wildlife Service 1984).

Interior Grassland Habitats

Grassland losses have continued to result from urban expansion and conversion to irrigated croplands. Degradation of grassland quality also continues, especially on heavily grazed rangelands. Conversely, grasslands are also being created by conversion of other native habitats for grazing.

Alkali Scrub Habitats

Alkali scrub habitat continues to decline because of agricultural conversion, flood control, and groundwater pumping.

Oak Woodland Habitats

Continued habitat loss and decline results from clearing for livestock forage improvement, residential and commercial development, fuel-wood harvesting, agricultural conversion, and other activities. In many areas, remaining oak woodlands are declining due to lack of regeneration and survival of young trees. The reasons for the lack of stand regeneration in oaks are not well understood; however, competition with introduced grasses; fire suppression; and consumption of acorns and seedlings by livestock, rodents, and other wildlife have all been implicated (Mayer et al. 1986, Griffin 1977). Urban and agricultural development, rangeland improvement, fuel harvesting, and other activities continue to eliminate oak woodland habitats.

Coniferous and Mixed Forest Habitats

Continuing timber harvest creates large areas of early-successional clearcuts and even-aged young stands, reduces the structural complexity of forests, diminishes the availability of snags and deadwood habitat, increases the fragmentation of habitat with logging roads and clearcuts, and causes soil erosion into streams. Local areas of forest are severely affected by mining and the growth of urban areas.

Chaparral Habitats

Chaparral habitat continues to be converted to urban areas and agricultural land. In many areas deterioration of remaining habitat results from fire suppression, which leads to excess accumulations of woody material and unusually large and intense conflagrations when fires eventually occur (Hanes 1977). Lack of ground-cover subsequently facilitates flooding and runoff. In turn, this may produce silting of downstream aquatic habitats.

The species associated with gabbro soils are declining as a result of: habitat loss, fragmentation, and alteration of natural ecosystem processes caused by residential and commercial development; grading, road construction and maintenance; fire suppression; herbicide use; unauthorized dumping; mining; and other activities (59 **FR** 18774).

Fifteen active surface mines on private land near Ione continue to remove Ione soils habitat; approved reclamation plans show that in excess of 3,500 acres of surface removal will occur. Plants on Ione soils are also threatened by disease, clearing of vegetation for irrigated/cultivated agriculture and fire protection, habitat fragmentation, residential and commercial development, changes in fire frequency, and ongoing erosion.

Sierra and Coastal serpentine habitats are being reduced and degraded by urbanization. Species on serpentine soils are also adversely affected by firebreak construction, agricultural land conversion, livestock grazing, trash dumping, off-road vehicle use, recreational gold mining, and trampling by hikers.

Coastal Scrub and Coastal Grassland Habitats

Four major factors contribute to changes in the distribution and composition of coastal prairies: the introduction of highly competitive, non-native species; an increase in grazing pressures; the elimination of annual fires; and cultivation (Heady et al. 1988). In addition, urban growth is increasingly causing fragmentation and restriction of coastal prairie and coastal scrub habitat. Threats to species on these habitats include loss of habitat to urbanization, road-kill fatalities, illegal collection, off-road vehicle use, unsuitable levels of livestock grazing, trampling of food plants by horses and hikers, use of insecticides, rock and sand quarrying, and invasive non-native species.

Ongoing threats to listed and proposed species on serpentine habitats in the Bay Area include urban growth (including residential developments, golf courses, road and highway construction, and waste disposal), recreational use of open space (resulting in erosion and facilitating growth of

weedy species), invasion by non-native plants, and ecological changes resulting from severe habitat reduction and fragmentation (57 **FR** 59053).

Threats to endemic species of Zayante sandhill habitats include destruction of habitat from residential development, recreational activities, equestrian use, agriculture, invasion by non-native vegetation, changes in fire cycles, and sand mining.

Instream Flow, Water Impoundments and Diversions

Hydrodynamic conditions in the Delta are tied to continuing and future hydraulic modifications in the Delta made for various beneficial purposes, such as levee construction for land reclamation and flood control; channel dredging, enlargement, and deepening for navigation and levee maintenance; installation and operation of diversion pumps, siphons, and drainage pumps; and construction of non-Federal export pumping plants and associated facilities for water management. Increased demands may further reduce reservoir storage and will adversely affect riverine conditions. Reduced availability will result from: (1) operations that reduce the frequency of spill from upstream reservoirs; (2) build out by senior water right holders who currently do not make full use of their entitlements; and (3) changes in the criteria that define surplus flows. Continued upstream impoundment and diversion of snowmelt will reduce the potential for high spring outflows. Because surplus flows combined with required flows in the Water Quality Control Plan are critical for transporting fish larvae to rearing habitat and maintaining that rearing habitat in a suitable location in Suisun Bay, new diversions of surplus water will reduce the likelihood that fisheries declines will be reversed. Variation in climate between years can also exacerbate the cumulative effects of water diversions. Drought conditions increase demand for water while reducing the total amount of water available for fish and wildlife, agricultural, municipal and industrial uses, and can thus result in additional shortfalls in instream flow and upstream movement of the 2 parts-per-thousand (ppt) isohaline (X2). Extremely high precipitation events can also adversely affect endangered species. Delta fishes can suffer increased mortality if they are carried out of their preferred estuarine habitats toward San Francisco Bay by high outflows.

Contaminants and Water Quality

Agricultural and industrial activity can introduce contaminants into water used by threatened and endangered species. These contaminants may include selenium, arsenic, cadmium, chromium, copper, mercury, lead, nickel, silver, tributyltin, zinc, hydrocarbons, and organochlorines. Contaminants may enter surface waters through point source spills and discharges, urban and

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agricultural runoff, deposition of atmospheric aerosols, and dredging that releases contaminants trapped in sediments.

The major source of water contamination in the Central Valley is agricultural drainwater, which has high salinity, high selenium concentrations (particularly in water draining selenium-rich soils in the San Joaquin Valley), and pesticides. Dumping of highly saline drainwater into rivers can have similar adverse effects on aquatic organisms.

Evaporation ponds which concentrate selenium-rich drainwater can attract wetland animals which may then die or suffer developmental abnormalities from selenium toxicity. Broadcast spray of malathion and other pesticides in agricultural areas can drift into non-target areas, kill plant pollinators, reduce insect prey species, and contaminate runoff. Pesticides cause death of the small invertebrates and zooplankton that support the food chain, and can be toxic to higher-level predators by bioaccumulating to increased concentrations. Eggs and larvae of aquatic organisms are particularly vulnerable to mortality or developmental abnormalities from pesticides. Levee maintenance and dredging resuspends contaminants trapped in sediments. Selenium, pesticides, and herbicides may adversely affect delta smelt and Sacramento splittail reproductive success and survival rates.

Spillage of wastewater from mining activity (particularly the Iron Mountain Mine) could potentially introduce large pulses of water laden with contaminants such as copper, zinc, and cadmium into Central Valley river systems and the Delta. Central Valley waters could also be contaminated by incidental leakage of gasoline and oil from vehicles and storage tanks, illegal dumping of waste oil and other chemical wastes, or accidental spills of chemicals or petroleum products from tank trucks or rail cars. Release of contaminated ballast in San Francisco Bay by ships further reduces water quality.

Non-native Species

Non-native species continue to spread and be introduced into aquatic habitats of the Delta and Central Valley rivers. Releases of ballast water from ships or deliberate stocking of fish introduce non-native species into water bodies. Non-native euryhaline clams reduce the abundance of phytoplankton. (Euryhaline species are able to live in water with widely varying salinity.) Non-native diatoms growing in chains are more difficult for zooplankton to graze upon. Introduced copepods are more difficult to catch than native copepod species and may thus reduce food availability for native fishes. Introduced silversides and gobies may prey on eggs and larvae of native fishes. Larval striped bass and other non-native fish may compete for food and space with native fishes. Delta smelt may hybridize with the introduced Japanese pond smelt. Introduction

of large predatory fish such as northern pike has the potential to greatly increase mortality of native fishes.

Introduced bullfrogs pose a great threat to a variety of aquatic species, including snakes, fish, and other frog species. Adult bullfrogs are accomplished predators which can populate an area quickly and out-compete, as well as prey upon, the natives.

Introduced plants have also caused problems for native species. Non-native plants compete with native plants for light, space, and nutrients. The lack of natural population controls for non-native (e.g., predators, disease) can allow these species to out-compete native species and form a monoculture of an introduced species. Species such as the Brazilian elodea (*Egeria densa*) and yellow star-thistle (*Centaurea solstitialis*) have taken over aquatic and terrestrial habitats (respectively) in California.

Native Habitat Conversion and Associated Activities

Terrestrial and wetland habitats used by threatened and endangered species continue to be modified or converted by private entities, State agencies, or local governments. The increase in urbanization and agricultural conversion increases fragmentation and degradation of remaining habitat.

The uses associated with land conversions that occur include: oil and gas development; mining or quarrying for sand, gravel, or minerals; liquid waste treatment plants; wind farms; pipeline installation; transmission line installation; creation of reservoirs or evaporation ponds; construction of roads or other transportation infrastructure; urban or industrial developments; or agricultural conversion. Land conversions can result in take of a wide variety of threatened or endangered animal species, including but not limited to giant garter snake, California red-legged frog, San Joaquin kit fox, blunt-nosed leopard lizard, valley elderberry longhorn beetle, and vernal pool crustaceans. Numerous threatened and endangered plants of vernal pool, wetland, grassland, serpentine, and alkali scrub habitats are also affected by ongoing habitat conversion. Areas of endemism where habitat conversion would have disproportionately large effect on listed species include: remnant vernal pool complexes and riparian habitats in the Sacramento and San Joaquin Valleys; alkali scrub/grassland habitats of the San Joaquin Valley and Carrizo Plain; the San Bruno Mountain and Milagra Ridge area of San Mateo County; the gabbro and serpentine soils of the Pine Hill intrusion in El Dorado County; the Antioch Dunes in Contra Costa County; the Zayante sand hills of the Santa Cruz Mountains; and the serpentine soils of the San Francisco Bay and Santa Clara Valley areas. Many of these areas are currently under great pressure to be developed for municipal and industrial uses.

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Conversion of native land for agricultural uses, and conversion of agricultural lands from one use to another, continues to be the most critical threat to listed species. Although the increment of habitat loss attributable to urban development appears to be increasing, these activities remain less significant, for most species, than conversion of native habitats for irrigated/cultivated agriculture. Agricultural conversion is generally not subject to any environmental review; is not directly regulated and is only infrequently monitored. Conversion of privately owned habitat without use of federally supplied water or filling of wetlands typically does not result in section 7 consultation with the Service, nor is it usual for there to be an application for a section 10 incidental take permit. Illegal fill of wetlands without Corps permits has occurred in the past and is likely to continue. In addition, water is used for groundwater recharge by some districts in the San Joaquin Valley. Such recharge may allow nearby landowners to pump groundwater for uses that may affect listed and proposed species.

The California Department of Forestry (1988) has predicted wildland habitat losses totaling 110,000 acres in the Sacramento Valley region and 465,000 acres in the San Joaquin Valley region between 1980 and 2010 as a result of agricultural conversion and urbanization. Much of the projected loss is likely to occur in the remaining blocks of habitat for listed and proposed species.

During habitat conversion threatened and endangered species could be killed or injured by operation of heavy equipment (crushing, burial by earthmoving equipment, discing, grading, mowing) or flooding of habitat. Listed species could be harassed during construction by noise, ground vibrations and compaction of burrows, construction lighting, and disruption of foraging and breeding behavior. Listed species not killed directly by operation of equipment would probably find themselves in sub-optimal habitat with a decreased carrying capacity due to lower availability of foraging and breeding habitat and greater vulnerability to predation. If listed species were displaced from converted lands into nearby native habitat, population densities would rise and intraspecific competition and predation pressure would be likely to increase. Animals that loose their fear of humans can become more vulnerable to shooting, poisoning, and roadkill. Habitat conversion also reduces the availability of suitable habitat for future recovery of species and isolates populations by increasing habitat fragmentation.

Some listed terrestrial species (e.g., bald eagle, San Joaquin kit fox, kangaroo rats, giant garter snake) are vulnerable to accidental or intentional unauthorized take by electrocution on electric fences or power lines, trapping, shooting, clubbing, or poisoning. Incidental disturbance from human activity may also cause disruption of normal foraging and reproductive activities. Listed plants may be threatened by vandalism or horticultural collecting. Listed butterflies can be threatened by unauthorized collecting by lepidopterists. These forms of unauthorized take are

likely to occur more frequently as the human population in the Central Valley increases and native habitat is fragmented and converted.

Vehicular traffic is an ongoing hazard that can cause roadkill mortality for a wide variety of terrestrial listed species (e.g., giant garter snake, blunt-nosed leopard lizard, San Joaquin kit fox, California red-legged frog). Traffic will be increased by construction of new roads and agricultural, industrial, and urban development. As barriers to dispersal, roads also reduce the probability that unoccupied habitat will be colonized by listed species. Roadside maintenance can affect listed plants by grading, mowing, erosion control, and spraying of herbicides.

Off-road vehicles can kill or injure listed plants and animals, as well as causing erosion, harassing animals with noise and ground vibrations, and crushing burrows used for shelter. Heavy pedestrian foot traffic can also compact soil and trample plants and small or dormant animals.

Rodent control measures can: reduce the availability of prey for listed predators (e.g., San Joaquin kit fox); injure or kill listed predators through secondary poisoning if poisoned rodents are eaten; injure or kill other listed species (e.g., Fresno, Tipton, and giant kangaroo rats, San Joaquin, or riparian, woodrat) that may eat rodenticide-treated baits; and reduce the availability of ground squirrel burrows as shelter and hibernation refugia for listed species (e.g., giant garter snake, San Francisco garter snake, kangaroo rats). Use of burrow fumigants on levees and other potential upland refugia can injure or kill listed species sheltering in ground squirrel burrows.

Urban and agricultural development results in increased abundance of domestic and feral cats and dogs, as well as wild predators (such as raccoons, red foxes, and skunks) that are attracted to trash dumping and suburban developments. This high abundance of predators can result in increased predation rates for small terrestrial vertebrates, including listed species (e.g., blunt-nosed leopard lizard, giant garter snake, California red-legged frog). Listed predatory species such as the San Joaquin kit fox may similarly suffer increased competition for space and food. Other indirect effects from urbanization include increased disturbance levels, ground slumping, garbage dumping, altered fire regimes, vandalism to protected habitats, increased foot traffic through protected areas, and unauthorized activities that adversely affect the survival of rare species.

Listed plant species can be buried or killed by dumping of trash, fill dirt, or garden debris. Dredging and clearing of vegetation from irrigation canals reduces foraging habitat and escape cover for giant garter snakes. Listed species in wetland habitats (including vernal pool crustaceans and eggs and tadpoles of California red-legged frogs) may be injured or killed by

mosquito abatement measures including pesticide application and predation by introduced mosquitofish.

Hydrological changes caused by development can include changes in the water table or increased runoff from up slope agricultural irrigation, residential development, or golf courses. Erosion and slumping of soils may result from changes in hydrology. These effects may change the suitability of habitat for listed plant species.

Transformation of watercourses and wetlands from seasonal to permanent hydroperiods by irrigation and damming alters the plant and animal communities, allowing colonization by bass, sunfish, bullfrogs and emergent marsh vegetation such as cattails and tule reeds. Tadpoles of California red-legged frogs typically metamorphose by late summer and are able to survive if wetlands dry in early autumn. Bullfrogs, which are larger and have a longer tadpole period, will competitively exclude California red-legged frogs in permanent water bodies. Bullfrogs, bass, and sunfish will also prey on California red-legged frog eggs and tadpoles.

Oil exploration poses a threat to many species as well. Construction of pads and roads associated with oil development, as well as the process of finding oil deposits can disturb large areas of habitat. Noise, vibration, traffic, and other human disturbances can also adversely affect species in the area.

Grazing and Land Management

Livestock grazing on State and private lands can cause erosion and degradation of riparian vegetation that provides habitat for listed species such as the valley elderberry longhorn beetle, southwestern willow flycatcher, riparian brush rabbit, and San Joaquin (riparian) woodrat. Livestock wallows may degrade seasonal wetlands that harbor listed species. Trampling can also collapse rodent burrows used as shelter by some listed species. Listed plant species can be adversely affected by overgrazing and trampling, which can reduce survival and reproductive output of plants. However, in some cases moderate levels of grazing may be beneficial to listed plants, or to species such as the mountain plover, by preventing establishment of competing species. Management for high deer and elk populations can also result in increased grazing and browsing pressure on listed plant species.

Most native plant species have adapted to a certain level of grazing pressure. Grazing management practices are often incompatible with the continued survival of certain species. For many species, the grazing management that would best suit the species is simply unknown. This may lead to inappropriate habitat management practices.

Logging on State and private lands can kill or harm listed species that require mature forest habitat (e.g., marbled murrelet, northern spotted owl). These species could be directly killed or injured by destruction of active nests, or indirectly harmed by increasing predation risk or reducing the availability of nest sites, suitable foraging habitat, or prey.

Fire management activities can change the fuel load and the frequency and severity of fires. The fire regime can affect listed plants by changing germination success, seed bank composition, adult mortality, and intensity of interspecific competition.

Management regimes that pose a threat to species include: lack of protection on private lands, lack of funding for protection, lack of funding for correct management, management practices for one species that eliminates another, or inappropriate habitat management due to lack of information on the biology of the species. Private land management practices can also be incompatible with the continued viability of species.

Population Size and Life History

Certain aspects of the biology of species put them more at risk of extinction from habitat degradation and fragmentation. Small populations and/or short-lived species (e.g., delta smelt have a one-year life span) are more at risk to random catastrophic events than large populations. Events such as drought, flooding, predators or pests, fires, and disease can pose a serious threat to a species that is limited to only several small populations. Small populations are also at risk of genetic drift, hybridization with closely related species or subspecies, and inbreeding. The lack of genetic variability leaves species at further risk to random events. Many native species are dependent on rare habitat types, leaving them at risk from development in these areas. Species with low density, low reproductive rate, large home ranges, or dependency on social facilitation are further at risk to multiple stressors.

Conclusion

Listed Species/Critical Habitat

After reviewing the current status of the species in Appendix C, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's biological opinion that the extent of take anticipated at the programmatic level is not likely to result in jeopardy to the species listed in Appendix C, or destruction or adverse modification of critical habitat. In the absence of conservation measures or other CALFED Agency commitments listed in the Description of the Proposed Action, the effects analysis above would support a

conclusion of jeopardy for many of the listed species in the effected area. However, this no-jeopardy determination is based upon implementation of and compliance with all of the Key Planned Actions listed in the Description of the Proposed Action.

Proposed Species

After reviewing the current status of the species in Appendix C, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is the Service's conference opinion that the extent of take anticipated at the programmatic level is not likely to result in jeopardy to the species listed in Appendix C. In the absence of conservation measures or other CALFED Agency commitments listed in the Description of the Proposed Action, the effects analysis above would support a conclusion of jeopardy for many of the listed species in the effected area. However, this no-jeopardy determination is based upon implementation of and compliance with all of the Assumptions listed in the Description of the Proposed Action.

INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with this Incidental Take Statement.

Sections 7(b)(4) and 7(o)(2) of ESA do not apply to the incidental take of listed plant species. However, protection of listed plants is provided to the extent that ESA requires a Federal permit for removal or reduction to possession of endangered plants from areas under Federal jurisdiction, or for any act that would remove, cut, dig up, or damage or destroy any such species on any other area in knowing violation of any regulation of any State law, including the California Endangered Species Act, or in the course of any violation of a State criminal trespass law.

Due to the programmatic nature of these biological and conference opinions, the project- and site-specific information necessary to determine the amount and extent of incidental take of listed and proposed species associated with individual CALFED Program activities/actions is lacking. Thus, CALFED Agencies will initiate individual Section 7 consultations or develop individual habitat conservation plans in coordination with the Service for actions/activities which may affect listed and proposed species. Future biological and conference opinions that are tiered under this programmatic opinion will estimate, evaluate, and authorize the amount and extent of incidental take associated with project-specific actions. Incidental take of listed and proposed species is not authorized in this programmatic biological opinion.

Reporting Requirements

The CALFED Agencies shall notify the Service immediately if dead or injured endangered species are found during implementation of actions or on CALFED Agencies' lands. CALFED Agencies must submit a report including date(s), location(s), habitat description, and any corrective measures taken to protect the individual(s) found. If endangered animals are captured, the report shall also include photographs of the individuals, condition of the individual, length of time held, release location, and any other pertinent information.

For all endangered species encountered during construction and construction-related activities, CALFED Agencies shall submit locality information to the California Department of Fish & Game (CDFG), using completed California Native Species Field Forms or their equivalent, within 90 calendar days of the species being observed. Each form shall have an accompanying scale map of the site (such as a photocopy of a portion of the appropriate 7.5 minute U.S. Geological Survey map) and shall provide at least the following information: township, range, and quarter section; name of the 7.5- minute or 15-minute quadrangle; dates (day, month, year) of field work; number of individuals and life stage (where appropriate) encountered; and a description of the habitat by community-vegetation type.

For those projects requiring a Service-approved biologist or where mitigation is required, a post-construction compliance report prepared by the Service-approved monitoring biologist shall be forwarded to the Chief, Endangered Species Division, at the Sacramento Fish and Wildlife Office within 60 calendar days of the completion of each project and shall include the file number of this consultation on the cover sheet (1-1-F-00-184). This report shall detail (1) dates that construction occurred; (2) pertinent information concerning the applicant's success in meeting project mitigation measures; (3) an explanation of failure to meet such measures, if any; (4) known project effects on federally listed species, if any; (5) occurrences of incidental take of

federally listed species, if any, (including handling and relocation); and (6) other pertinent information.

REINITIATION-CLOSING STATEMENT

This concludes formal consultation and conference on the actions outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation.

Reinitiation will occur not later than 180 days prior to September 30, 2004. The purpose of the reinitiation is to evaluate the efficacy of the EWA and progress toward achieving the Milestones, including funding commitments, in conserving and promoting the recovery of listed species. The reinitiation of consultation is expected to result in supplemental biological opinions, which could be appended to the original biological opinions.

You may ask the Service to confirm the conference opinion as a biological opinion issued through formal consultation if the species are listed. The request must be in writing. If the Service reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, the Service will confirm the conference opinion as the biological opinion on the CALFED Program and no further section 7 consultation will be necessary.

After listing of the species and any subsequent adoption of this conference opinion, the Federal Agencies shall request reinitiation of consultation if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion; or (4) a new species is listed or critical habitat designated that may be affected by the action.

The incidental take statement provided in this conference opinion does not become effective until the species is listed and the conference opinion is adopted as the biological opinion issued through formal consultation. At that time, the project will be reviewed to determine whether any take of the species has occurred. Modifications of the opinion and incidental take statement may be appropriate to reflect that take. No take of the species may occur between the listing of the species and the adoption of the conference opinion through formal consultation, or the completion of a subsequent formal consultation.

Appendices

Appendix A--Maps
Appendix B–List of Listed and Proposed Species in Focus Area
Appendix C--Species Accounts
Appendix D–Proposed Programmatic Actions Evaluated
Appendix E--EWA Operating Principles
Appendix F–T&E Take Avoidance and Minimization Measures
Appendix G–T&E Compensation Measures
Appendix H–General Measures to Avoid and Minimize Take
Appendix I–Botanical Inventory Guidelines
Appendix J--Milestones

LITERATURE CITED

The literature cited in this biological opinion is contained within Service files and is available upon request.

Appendix A. Maps of the CALFED Program Areas and Regions

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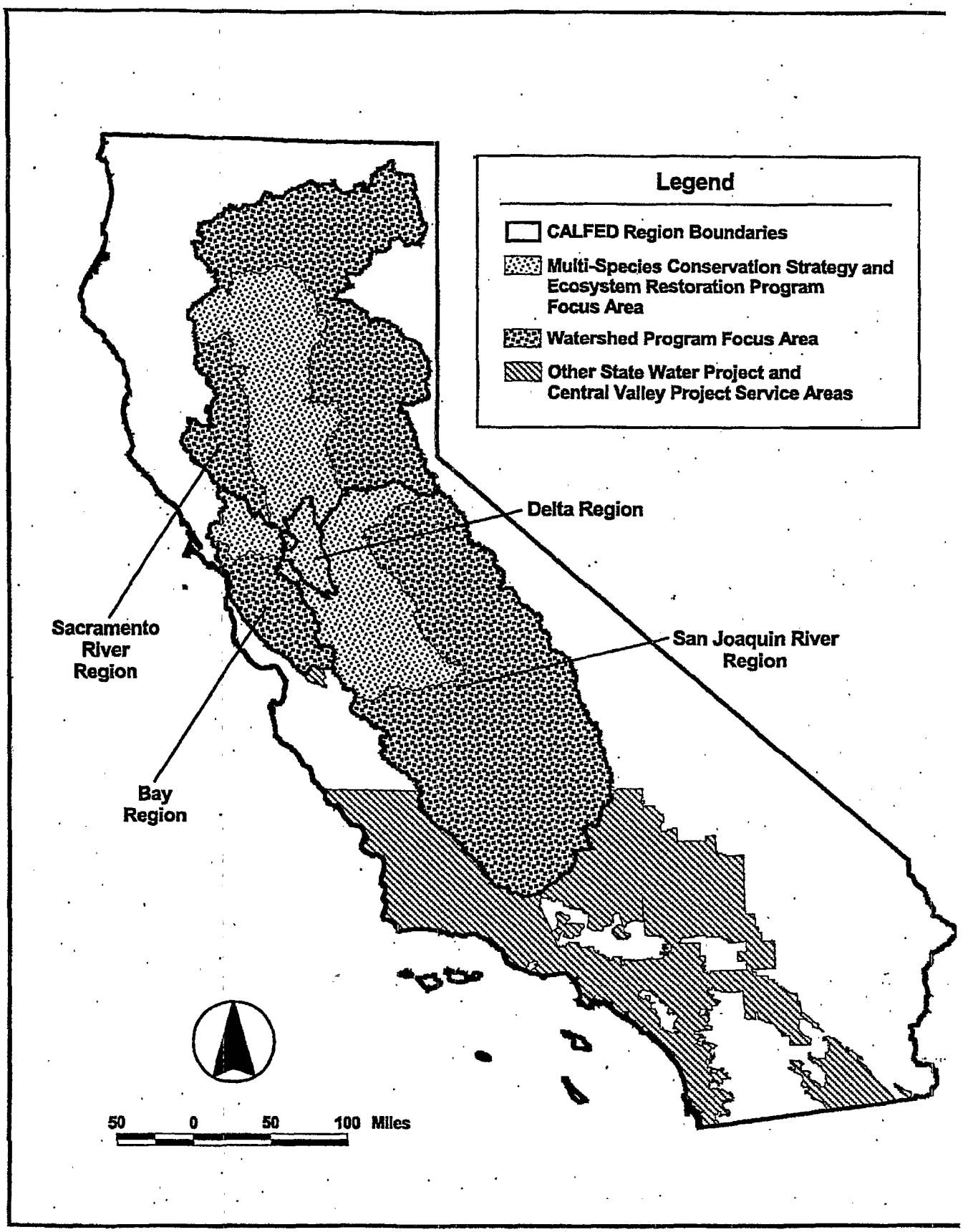

Figure A-
CALFED Program Areas and Regior

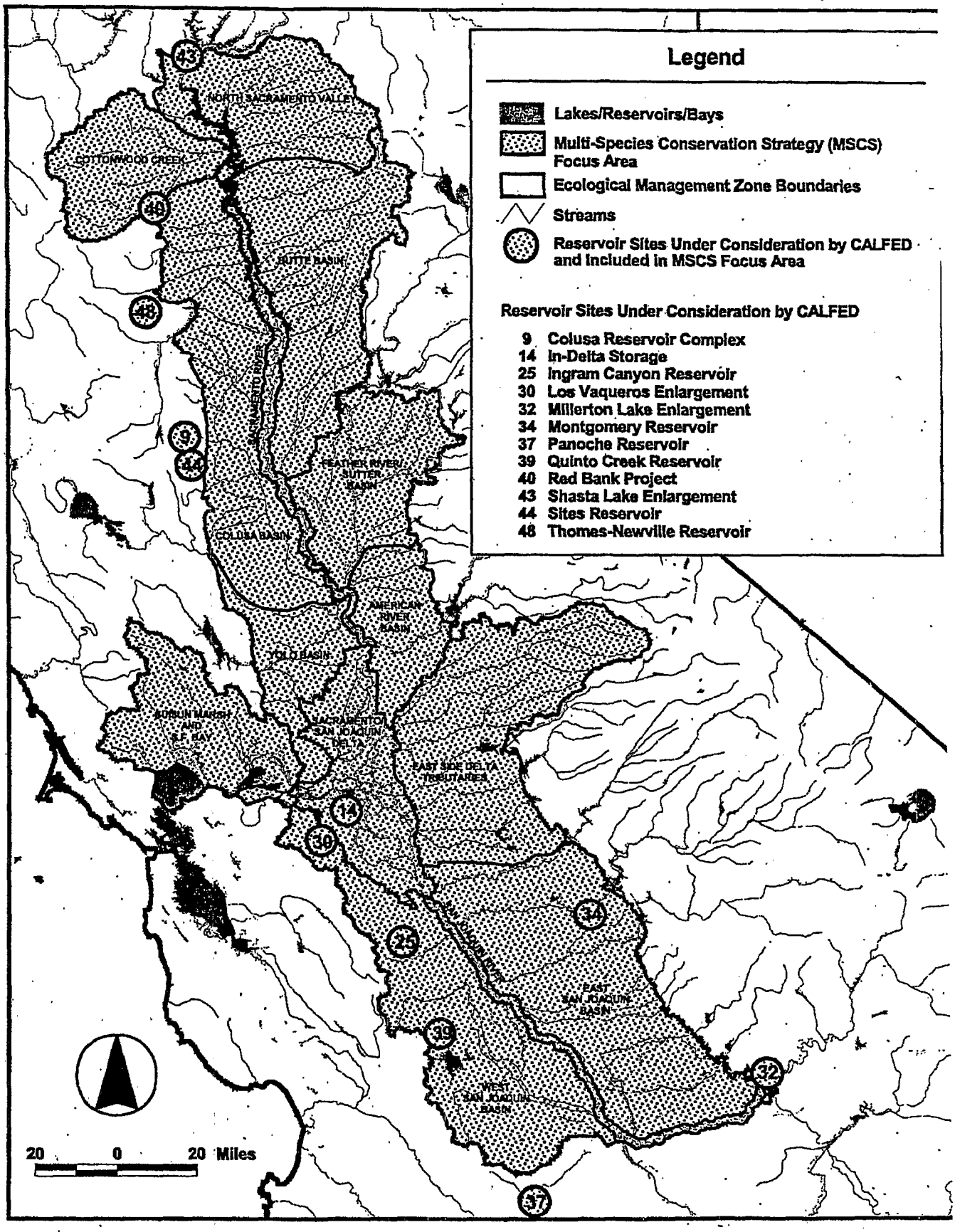

Figure A-
Multi-Species Conservation Strategy Focus Are

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Appendix B. Listed and Proposed Species in the Focus Area

Endangered and Threatened Species that May Occur within or be Affected by Activities within the Boundaries of the CalFed Project

Listed Species

Mammals

Fox, San Joaquin kit, *Vulpes macrotis mutica* (E)

Mouse, salt marsh harvest, *Reithrodontomys raviventris* (E)

Rabbit, riparian brush, *Sylvilagus bachmani riparius* (E)

Rat, Fresno kangaroo, *Dipodomys nitratoides exilis* (E)

Rat, Tipton kangaroo, *Dipodomys nitratoides nitratoides* (E)

Rat, giant kangaroo, *Dipodomys ingens* (E)

Sheep, Sierra Nevada (=California) bighorn, *Ovis canadensis californiana* (E)

Woodrat, riparian (San Joaquin Valley), *Neotoma fuscipes riparia* (E)

Birds

Condor, California, *Gymnogyps californianus* (E)

Eagle, bald, *Haliaeetus leucocephalus* (T)

Flycatcher, southwestern willow, *Empidonax traillii extimus* (E)

Goose, Aleutian Canada, *Branta canadensis leucopareia* (T)

Murrelet, marbled, *Brachyramphus marmoratus* (T)

Owl, northern spotted, *Strix occidentalis caurina* (T)

Pelican, California brown, *Pelecanus occidentalis californicus* (E)

Plover, western snowy, *Charadrius alexandrinus nivosus* (T)

Rail, California clapper, *Rallus longirostris obsoletus* (E)

Tern, California least, *Sterna antillarum (=albifrons) browni* (E)

Vireo, Least Bell's, *Vireo bellii pusillus* (E)

Fish

Goby, tidewater, *Eucyclogobius newberryi* (E)

Smelt, delta, *Hypomesus transpacificus* (T)

Splittail, Sacramento, *Pogonichthys macrolepidotus* (T)

Sucker, shortnose, *Chasmistes brevirostris* (E)

Reptiles & Amphibians

Frog, California red-legged, (*Rana aurora draytonii)* (T)

Lizard, blunt-nosed leopard, (*Gambelia [=Crotaphytus] sila*) (E)

Snake, San Francisco garter, *Thamnophis sirtalis tetrataenia* (E)

Snake, giant garter, *Thamnophis gigas* (T)

Whipsnake, Alameda, *Masticophis lateralis euryxanthus* (T)

Invertebrates

Beetle, delta green ground, *Elaphrus viridis* (T)

Beetle, valley elderberry longhorn, *Desmocerus californicus dimorphus* (T)

Butterfly, Lange's metalmark, *Apodemia mormo langei* (E)

Butterfly, Myrtle's silverspot, *Speyeria zerene myrtleae* (E)

Butterfly, San Bruno elfin, *Incisalia mossii bayensis* (E)

Butterfly, bay checkerspot, *Euphydryas editha bayensis* (T)

Butterfly, callippe silverspot, *Speyeria callippe callippe* (E)

Butterfly, mission blue, *Icaricia icarioides missionensis* (E)

Crayfish, Shasta (=placid), *Pacifastacus fortis* (E)

Moth, Kern primrose sphinx, *Euproserpinus euterpe* (T)

Shrimp, California freshwater, *Syncaris pacifica* (E)

Shrimp, conservancy fairy, *Branchinecta conservatio* (E)

Shrimp, longhorn fairy, *Branchinecta longiantenna* (E)

Shrimp, vernal pool fairy, *Branchinecta lynchi* (T)

Shrimp, vernal pool tadpole, *Lepidurus packardi* (E)

Plants

Allocarya, Calistoga, *Plagiobothrys strictus* (E)

Alopecurus, Sonoma, *Alopecurus aequalis var. sonomensis* (E)

Bedstraw, El Dorado, *Galium californicum ssp. sierrae* (E)

Bird's-beak, palmate-bracted, *Cordylanthus palmatus* (E)

Bird's-beak, soft, *Cordylanthus mollis ssp. mollis* (E)

Bluegrass, Napa, Poa *napensis* (E)

Brodiaea, Chinese Camp, *Brodiaea pallida* (T)

Buckwheat, Ione, *Eriogonum apricum var. apricum* (E)

Buckwheat, Irish Hill, *Eriogonum apricum var. prostratum* (E)

Butterweed, Layne's, *Senecio layneae* (T)

Cactus, Bakersfield, *Opuntia treleasei* (E)

Ceanothus, Coyote, *Ceanothus ferrisae* (E)

Ceanothus, Pine Hill, *Ceanothus roderickii* (E)

Checkermallow, Kenwood Marsh, *Sidalcea oregana ssp. valida* (E)

Clarkia, Presidio, *Clarkia franciscana* (E)

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Clarkia, Springville, *Clarkia springvillensis* (T)

Clover, showy Indian, *Trifolium amoenum* (E)

Coyote-thistle, Loch Lomond, *Eryngium constancei* (E)

Dudleya, Santa Clara Valley, *Dudleya setchellii* (E)

Dwarf-flax, Marin, *Hesperolinon congestum* (T)

Eriastrum (= Woolly-star), Hoover's, *Eriastrum hooveri* (T)

Evening-primrose, Antioch Dunes, *Oenothera deltoides ssp. howellii* (E)

Evening-primrose, San Benito, *Camissonia benitensis* (T)

Fiddleneck, large-flowered, *Amsinckia grandiflora* (E)

Flannelbush, Pine Hill, *Fremontodendron californicum ssp. decumbens* (E)

Goldfields, Burke's, *Lasthenia burkei* (E)

Goldfields, Contra Costa, *Lasthenia conjugens* (E)

Grass, Colusa, *Neostapfia colusana* (T)

Grass, Solano, *Tuctoria mucronata* (E)

Howellia, water, *Howellia aquatilis* (T)

Jewelflower, California, *Caulanthus californicus* (E)

Jewelflower, Metcalf Canyon, *Streptanthus albidus ssp. albidus* (E)

Jewelflower, Tiburon, *Streptanthus niger* (E)

Larkspur, Baker's, *Delphinium bakeri* (E)

Larkspur, Yellow, *D. luteum* (E)

Layia, beach, *Layia carnosa* (E)

Lessingia, San Francisco, *Lessingia germanorum* (E)

Mallow, Kern, *Eremalche kernensis* (E)

Manzanita, Ione, *Arctostaphylos myrtifolia* (T)

Manzanita, Presidio (=Raven's), *Arctostaphylos hookeri ssp. ravenii* (E)

Manzanita, pallid, *Arctostaphylos pallida* (T)

Mariposa lily, Tiburon, *Calochortus tiburonensis* (T)

Meadowfoam, Butte County, *Limnanthes floccosa ssp. californica* (E)

Meadowfoam, Sebastopol, *Limnanthes vinculans* (E)

Milk-vetch, Clara Hunt's, *Astragalus clarianus* (E)

Morning-glory, Stebbins', *Calystegia stebbinsii* (E)

Navarretia, few-flowered, *Navarretia leucocephala ssp. pauciflora* (E)

Navarretia, many-flowered, *Navarretia leucocephala ssp. plieantha* (E)

Orcutt grass, Sacramento, *Orcuttia viscida* (E)

Orcutt grass, San Joaquin Valley, *Orcuttia inaequalis* (T)

Orcutt grass, hairy, *Orcuttia pilosa* (E)

Orcutt grass, slender, *Orcuttia tenuis* (T)

Owl's-clover, fleshy, *Castilleja campestris ssp. succulenta* (T)

Paintbrush, Tiburon, *Castilleja affinis ssp. neglecta* (E)

Penny-cress, Kneeland Prairie, *Thlaspi montanum var. californicum* (E)

Pentachaeta, white-rayed, *Pentachaeta bellidiflora* (E)

Piperia (=rein orchid), Yadon's, *Piperia yadonii* (E)

Pitkin marsh lily, *Lilium pardalinum* ssp. *Pitkinense* (E)

Potentilla (=cinquefoil), Hickman's, *Potentilla hickmanii* (E)

Pussy-paws, Mariposa, *Calyptridium pulchellum* (T)

Sandwort, marsh, *Arenaria paludicola* (E)

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Sea-blite, California, *Suaeda californica* (E)

Sidalcea, Keck's, *Sidalcea keckii* (E)

Spineflower, Ben Lomond, *Chorizanthe pungens var. hartwegiana* (E)

Spineflower, Monterey, *Chorizanthe pungens var. pungens* (T)

Spineflower, Sonoma, *Chorizanthe valida* (E)

Spineflower, robust, *Chorizanthe robusta* (E)

Spurge, Hoover's, *Chamaesyce hooveri* (T)

Stickyseed, Baker's, *Blennosperma bakeri* (E)

Stonecrop, Lake County, *Parvisedum leiocarpum* (E)

Sunburst, Hartweg's golden, *Pseudobahia bahiifolia* (E)

Sunburst, San Joaquin adobe, *Pseudobahia peirsonii* (T)

Tarplant, Santa Cruz, *Holocárpha macradenia* (T)

Thistle, Suisun, *Cirsium hydrophilum var. hydrophilum* (E)

Thistle, fountain, *Cirsium fontinale var. fontinale* (E)

Thornmint, San Mateo, *Acanthomintha duttonii* (E)

Tuctoria, Greene's, *Tuctoria greenei* (E)

Vervain, Red Hills, *Verbena californica* (T)

Wallflower, Ben Lomond, *Erysimum teretifolium* (E)

Wallflower, Contra Costa, *Erysimum capitatum ssp. angustatum* (E)

White sedge, *Carex albida*, (E)

Woolly sunflower, San Mateo, *Eriophyllum latilobum* (E)

Woolly-threads, San Joaquin, *Lembertia congdonii* (E)

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Proposed Species

Mammals

Shrew, Buena Vista Lake, *Sorex ornatus relictus* (PE)

Birds

Plover, mountain, *Charadrius montanus* (PT)

Plants

Santa Cruz tarplant, *Holocarpha macradenia* (PT)

Candidate Species

Fish

Trout, McCloud River redband, *Oncorhynchus (=Salmó) mykiss ssp.* (C)

Reptiles & Amphibians

Salamander, California tiger, *Ambystoma californiense* (C)

Appendix C-1. Species Accounts for Species Evaluated in This Biological Opinion

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GIANT KANGAROO RAT *(Dipodymous ingens)*

Legal Status. The giant kangaroo rat is listed as endangered under the California and federal Endangered Species Acts.

Historical and Current Distribution and Status. The historical distribution of the giant kangaroo rat included the foothills of the western San Joaquin Valley, from the base of the Tehachapi Mountains in the south to just south of Los Banos (Merced County) in the north, the Carrizo and Elkhorn Plains, and the Cuyama Valley. Up until the 1950s, the giant kangaroo rat inhabited an estimated 631,000 hectares within its range (Williams et al. 1997).

The giant kangaroo rat is currently found in less than 2% of its historical range. The population of this species is scattered in six major geographic regions: the Panoche Region in western Fresno and eastern San Benito Counties, Kettleman Hills in Kings County, San Juan Creek Valley in San Luis Obispo County, Lokern, Elk Hills and other areas in western Kern County, Carrizo Plain Natural Area in eastern San Luis Obispo County, and Cuyama Valley in Santa Barbara and San Luis Obispo Counties (William et al. 1997).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The giant kangaroo rat is present in the East San Joaquin Basin, San Joaquin River, and West San Joaquin Basin Ecological Zones.

Life History and Habitat Requirements. Giant kangaroo rats inhabit sparsely vegetated grasslands on gentle slopes with quickly draining, sandy-loam soils (California Department of Fish and Game 1992). Populations are limited to areas having less than 6 inches of rain and are generally found at elevations at less than 3,000 feet (Williams 1992). The species feeds almost exclusively on the seeds of annual plants, such as brome grasses and filarees. Individuals harvest, stack, and dry the grasses and forbs near the entrance to their burrows (California Department of Fish and Game 1992).

Reasons for Decline. Loss of habitat for agricultural and urban development is the primary reason for the decline of the giant kangaroo rat and the decline is apparently continuing as more grassland is converted to agricultural fields. Intensive livestock grazing and the use of rodenticides may also contribute to the continued decline of this species (Williams 1980).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

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RIPARIAN BRUSH RABBIT *(Sylvilagus bachmani riparius)*

Legal Status. The riparian brush rabbit is listed as endangered under the California and federal Endangered Species Acts.

Historical and Current Distribution and Status. The riparian brush rabbit inhabits riparian communities along the lower portions of the San Joaquin and Stanislaus Rivers in the northern San Joaquin Valley, California. Because the subspecies was not described until after it is believed to have been extirpated from most of its historical range, definitive information on its former distribution is lacking. It apparently has been extirpated from the Sacramento-San Joaquin River Delta and most of the lower San Joaquin River and its tributaries—the Stanislaus, Tuolumne, and Merced Rivers (Williams 1986). The range of the subspecies probably extended farther upstream than the Merced River, assuming that suitable habitat historically occurred along the length of the San Joaquin River system (Williams and Basey 1986).

The riparian brush rabbit is currently restricted to a single population at Caswell Memorial State Park, San Joaquin County, along the Stanislaus River (Williams and Basey 1986). Surveys conducted in all potential habitat along the Merced, San Joaquin, Stanislaus, and Tuolumne Rivers during 1985 and 1986 failed to find any additional populations of riparian brush rabbits (Williams 1988). The most recent estimates indicate the population comprises 170–608 individuals over 198 acres (Williams 1993). Williams (1988) estimated a population low of 10 or fewer individuals following severe winter flooding in 1985 and 1986. The flooding during winter 1996–1997 has also severely affected the population. The riparian brush rabbit population is declining (California Department of Fish and Game 1992).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The species is present in the East San Joaquin Basin Ecological Zone; it historically occurred in the San Joaquin River, West San Joaquin Basin, and Sacramento-San Joaquin Delta Ecological Zones.

Life History and Habitat Requirements. Habitat for the riparian brush rabbit consists of riparian forests with a dense understory shrub layer. Common plants in the habitat include California wild rose, Pacific blackberry, wild grape, Douglas' coyote bush, and various grasses (Williams 1988, Basey 1990). Brush rabbits have small home ranges that usually conform to the size of available brushy habitat (Basey 1990).

Reasons for Decline. Potential threats to this species include habitat conversion to agriculture, wildfire, disease, predation, flooding, clearing of riparian vegetation, and the use of rodenticides. There has been a statewide reduction of riparian communities by nearly 90% because of elimination and modification of riparian forests along valley floor river systems to urban, commercial, and agricultural development; wood cutting; reclamation and flood control activities; heavy groundwater pumping; river channelization; dam building; and water diversion. The species is at risk from the lack of elevated mounds with protective cover to serve as flood refuges within remaining riparian habitat.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A draft recovery plan has been prepared for upland and riparian species in the San Joaquin Valley, including the riparian brush rabbit (U.S. Fish and Wildlife Service 1997). The recovery plan includes three actions: establish an emergency plan and monitoring system to provide swift action to save individuals and habitat at Caswell Memorial State Park in the event of flooding, wildfire, or a disease epidemic; develop and implement a cooperative riparian brush rabbit conservation program; and reevaluate the status of the rabbit within 3 years of recovery plan approval.

Citations

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SALT MARSH HARVEST MOUSE *(Reithrodontomys raviventris)*

Legal Status. The salt marsh harvest mouse is listed as endangered under the California and federal Endangered Species Acts and as fully protected under the California Fish and Game Code.

Historical and Current Distribution and Status. The salt marsh harvest mouse is endemic to saltwater and brackish water marshes adjoining San Francisco Bay and its tributaries (Shellhammer 1982). It was formerly found throughout the extensive marshes that once bordered San Francisco, San Pablo, and Suisun Bays (California Department of Fish and Game 1980). The species is now restricted to fragmented and widely separated saline or brackish emergent wetlands.

Known populations of salt marsh harvest mice exist at the Leslie Salt intake and Mare Island in Solano County, lower Tubbs Island in Sonoma County, Novato and Gallinas Creeks in Marin County, Albrad Slough and Triangle Marsh in Alameda County, Bair and Bird Islands in San Mateo County (U.S. Fish and Wildlife Service 1984), the Palo Alto Bay saltmarsh in Santa Clara County (Wondolleck et al. 1976), Petaluma Marsh in Sonoma County, and in tidal marshes located near Napa in Napa County. The species has also been found along the Sacramento River Delta at Grizzly and Joice Island Wildlife Management Areas (Schaub 1971) and near Collinsville (Shellhammer 1979) in Solano County.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The salt marsh harvest mouse is present in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. The salt marsh harvest mouse breeds from May to November and may produces up to two litters per year. Optimal habitat for this species is saline emergent wetland with 100% plant cover, consisting predominantly of pickleweeds in association with fat hen and alkali heath (Shellhammer 1982). Suitable wetlands are 100 or more acres, with an upper edge of peripheral halophytes (salt-loving plants) for refuge during high tides or floods (Shellhammer 1982). The salt marsh harvest mouse will also use marginal upland habitats (Zetterquist 1977, Botti et al. 1986).

Reasons for Decline. Habitat destruction is the greatest threat to this species (U.S. Fish and Wildlife Service 1984). By 1979, filling, flooding, or other conversions of marshes in the San Francisco Bay Area for commercial purposes had removed 79% of the tidal marshes (Jones & Stokes Associates et al. 1979). Additionally, much of the remaining area was converted to diked wetland, most of which became marginal or unsuitable habitat for the salt marsh harvest mouse (U.S. Fish and Wildlife Service 1984). Marsh subsidence, changes in salinity, plowing, mowing, burning, and artificial flushing have caused adverse impacts on this species' habitat by changing plant species composition or reducing vegetation used for cover (Shellhammer 1982).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. USFWS (1984) developed a recovery plan for the salt marsh harvest mouse and California clapper rail. The objectives of the plan are to secure and manage approximately 15,360 acres of occupied essential habitat under various government

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jurisdictions and approximately 12,800 acres of occupied, unsecured, essential habitat, mostly under private ownership. Additionally, the plan states that 27,500 acres of tidal marsh and diked historical bay lands would be restored and enhanced. Achievement of these objectives would allow the northern subspecies to be upgraded to threatened under the federal Endangered Species Act and delisting considered, and the southern subspecies upgraded to threatened. The southern subspecies could also be considered for delisting if an additional 11,800 acres of essential habitat are restored or enhanced and marsh restoration at the San Francisco Bay National Wildlife Refuge is completed. The plan is currently being revised by USFWS.

Citations

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SAN JOAQUIN KIT FOX *(Vulpes macrotis mutica)*

Legal Status. The San Joaquin kit fox is listed as threatened under the California Endangered Species Act and as endangered under the federal Endangered Species Act.

Historical and Current Distribution and Status. Although the precise historical range of the San Joaquin kit fox is unknown, it is believed to have extended from Contra Costa and San Joaquin Counties in the north to Kern County in the south. By the 1930s, the range had been reduced to the southern and western portions of the Central Valley (Grinnell et al. 1937). Surveys conducted between 1969 and 1975 extended the known range of the kit fox back into portions of its historical range in the northern San Joaquin Valley, including Contra Costa, Alameda, and San Joaquin Counties (Orloff et al. 1986). Additionally, kit foxes were found in three counties outside the originally defined historical range: Monterey, Santa Clara, and Santa Barbara (Orloff et al. 1986).

The original range of the San Joaquin kit fox was estimated to encompass approximately 8,670 square miles, supporting anywhere between 8,670 and 12,135 adult foxes. By 1975, an estimated 42% of suitable habitat had been lost to development, particularly irrigated agriculture, and the kit fox population size was estimated to be 7,000 individuals (U.S. Fish and Wildlife Service 1983, California Department of Fish and Game 1989). Most of the range defined in 1975 still supports kit foxes (California Department of Fish and Game 1989), although populations are declining (California Department of Fish and Game 1988) and those in the northern portion of the species' range are small and isolated (U.S. Fish and Wildlife Service 1983).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The San Joaquin kit fox is present in the East San Joaquin Basin, West San Joaquin Basin, and Sacramento-San Joaquin Delta Ecological Zones.

Life History and Habitat Requirements. San Joaquin kit foxes occur in seasonal wetland, alkali desert scrub, grassland, and valley foothill hardwood habitats (U.S. Fish and Wildlife Service 1983). Before the rapid expansion of irrigated agriculture in the San Joaquin Valley, the alkali desert scrub association was probably the species' prime habitat (Grinnell et al. 1937).

Kit foxes are primarily nocturnal and carnivorous. Major prey includes kangaroo rats, black-tailed hares, desert cottontails, deer mice, and California ground squirrels. Although kangaroo rats are a dominant prey item in the San Joaquin Valley (U.S. Fish and Wildlife Service 1983), California ground squirrels are the most important prey item in some other portions of the kit fox's range (Balestreri 1981, Hall 1983, O'Farrell et al. 1987, Clifton 1989). Kit foxes apparently do not require drinking water (Egoscue 1956, Morrell 1972).

Kit fox home-range sizes vary from 640 to 1,280 acres, with substantial overlap among individuals (Morrell 1972, Zoellick et al. 1987). The foxes usually inhabit areas with loose-textured soils suitable for den excavation (U.S. Fish and Wildlife Service 1983). Where soils make digging difficult, the foxes frequently use and modify burrows built by other animals (Orloff et al. 1986).

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Structures such as culverts, abandoned pipelines, and well casings may also be used as den sites (U.S. Fish and Wildlife Service 1983).

The foxes change den sites frequently, moving most often in summer. Pairs are formed during winter, with young born in spring (Morrell 1972). Natal dens are used from December through May, with the same natal dens often used in subsequent years (U.S. Fish and Wildlife Service 1983). Den changes may occur in response to a depleted prey base or increased numbers of fleas or other external parasites (Egoscue 1956).

Reasons for Decline. The San Joaquin kit fox population has declined primarily as a result of habitat loss to agricultural, urban, industrial, and mineral development in the San Joaquin Valley (U.S. Fish and Wildlife Service 1983). In 1979, only 6.7% of the native habitats in the San Joaquin Valley south of Stanislaus County remained untilled or undeveloped (O'Farrell et al. 1987). Road kills, illegal shooting and trapping, and secondary poisoning and prey reduction from rodent control programs may be significant factors in the species' decline.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. USFWS approved a recovery plan for the San Joaquin kit fox in 1983 (U.S. Fish and Wildlife Service 1983), which outlines steps allowing for the reclassification of the kit fox to threatened. Before the consideration of reclassification of the kit fox, three objectives must be achieved: 35,000 acres of habitat must be secured within a high-priority area, protection of the kit fox and its habitat throughout the species' range must be provided, and management of the kit fox must provide at least 1.4 adult animals per square mile on private and public lands. The highest priority kit fox populations are within western Kern and eastern San Luis Obispo Counties, the federal lands in the Elk Hills, and the Carrizo and Elkhorn Plains (U.S. Fish and Wildlife Service 1983).

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SAN JOAQUIN VALLEY WOODRAT *(Neotoma fuscipes riparia)*

Legal Status. The San Joaquin Valley woodrat is designated as a California species of special concern and is listed as endangered under the federal Endangered Species Act.

Historical and Current Distribution and Status. The San Joaquin Valley woodrat inhabits San Joaquin Valley communities along the lower portions of the San Joaquin and Stanislaus Rivers in the northern San Joaquin Valley, California. Historical records for the San Joaquin Valley woodrat indicate that the species was distributed in communities along the San Joaquin, Stanislaus, and Tuolumne Rivers; along Corral Hollow in San Jose County; elsewhere in San Joaquin and Stanislaus Counties, and in Merced County (Hooper 1938, Williams 1986). Before the statewide reduction of San Joaquin Valley communities by nearly 90% (Katibah 1984), the San Joaquin Valley woodrat probably ranged throughout the extensive San Joaquin Valley forests along major streams flowing onto the floor of the northern San Joaquin Valley. Today, San Joaquin Valley woodrat populations are greatly depleted, with the only known population at Caswell Memorial State Park and a possible second population near Vernalis, San Joaquin County. Williams (1993) estimated a peak population at Caswell of 437 animals, based on a mean density of 4.8 woodrats per hectare on 223 acres of suitable habitat.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The species is present in the East San Joaquin Basin Ecological Zone and could be present in the West San Joaquin Basin Ecological Zone. It historically occurred in the San Joaquin River, East San Joaquin Basin, West San Joaquin Basin, and Sacramento-San Joaquin Delta Ecological Zones.

Life History and Habitat Requirements. San Joaquin Valley woodrats are most abundant where shrub cover is dense and least abundant in open areas. In San Joaquin Valley areas, highest densities of woodrats and their nests are often encountered in willow thickets with an oak overstory. The species is common where there are deciduous valley oaks but few live oaks. Mostly active at night, the woodrat's diet is diverse and principally herbivorous, comprising leaves, fruits, terminal shoots of twigs, flowers, nuts, and fungi. The young are born in stick nest structures or "lodges" (located on the ground) that are 2–3 feet high and 4–6 feet in diameter. Most lodges are positioned over or against logs (Cook 1992, cited in Williams 1993). Unlike other subspecies of the dusky-footed woodrat, the San Joaquin Valley woodrat occasionally builds nests in cavities in trees and artificial wood-duck nest boxes (Williams 1986).

Reasons for Decline. Potential threats to this species include habitat conversion to agriculture, wildfire, disease, predation, flooding, drought, clearing of San Joaquin Valley vegetation, use of rodenticides, and browsing and trampling by ungulates. There has been a statewide reduction of San Joaquin Valley communities by nearly 90% (Katibah 1984) from elimination and modification of San Joaquin Valley forests along valley-floor river systems to urban, commercial, and agricultural development; wood cutting; reclamation and flood control activities; heavy groundwater pumping; river channelization; dam building; and water diversion.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. USFWS prepared a draft recovery plan for arid-upland and San Joaquin Valley species, including the San Joaquin Valley woodrat, for the San Joaquin Valley (U.S. Fish and Wildlife Service 1997). The conservation actions include: surveying and mapping all San Joaquin Valley areas along the San Joaquin River and its major tributaries; developing incentive programs in collaboration with landowners and local levee-maintenance districts for preserving San Joaquin Valley vegetation; developing a plan for restoring San Joaquin Valley habitat and establishing San Joaquin Valley corridors and, if necessary, reintroducing San Joaquin Valley woodrats to suitable habitat; initiating a genetic study to determine inbreeding levels and devising a procedure for ensuring that translocations have no adverse effects on the species; establishing conservation easements to accomplish habitat restoration, linkage, and reintroduction goals; beginning efforts to restore and link San Joaquin Valley habitats and reintroduce woodrats as appropriate; and reevaluating the status of the woodrat within 3 years of recovery plan approval.

Citations

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ALEUTIAN CANADA GOOSE *(Branta canadensis* ssp. *leucopareia)*

Legal Status. The Aleutian Canada goose is federally listed as threatened under the Endangered Species Act.

Historical and Current Distribution and Status. Historically, Aleutian Canada geese wintered from British Columbia to California and northwestern Mexico. Although they occurred throughout California, the greatest concentrations were found in the Sacramento and San Joaquin Valleys (Grinnell and Miller 1944). The subspecies bred throughout the Aleutian Islands and into Russia (Springer 1977).

The present population of Aleutian Canada geese migrates along the northern California coast and winters in the Central Valley near Colusa and on scattered feeding and roosting sites along the San Joaquin River from Modesto to Los Banos (Jones & Stokes Associates and CH2M Hill 1986, Nelson et al. 1984). Fall migration usually begins in late August or early September, with birds arriving in the Central Valley between October and early November (U.S. Fish and Wildlife Service 1980). Spring migration usually begins in mid-February and continues to early March (U.S. Fish and Wildlife Service 1980). The current population estimate is approximately 24,000 individuals (63 FR 68:17,350–17,352).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The Aleutian Canada goose is present during fall and winter in the Colusa Basin, East San Joaquin Basin, and West San Joaquin Basin Ecological Zones. During migration, it could also occur in the Butte Basin, Feather River/Sutter Basin, Yolo Basin, and Sacramento-San Joaquin Delta Ecological Zones.

Life History and Habitat Requirements. Aleutian Canada geese forage in harvested cornfields, newly planted or grazed pastures, or other agricultural fields (e.g., rice stubble and green barley). Lakes, reservoirs, ponds, and flooded fields are used for roosting and loafing (Grinnell and Miller 1944, U.S. Fish and Wildlife Service 1982). They also roost in large marshes and stockponds.

Reasons for Decline. Predation by introduced Arctic foxes on the breeding islands is the primary reason for the population decline (Yparraguirre 1978). Predation by these foxes eliminated most breeding colonies of the Aleutian Canada goose and, by the 1930s, the subspecies was nearly extinct, with only one breeding colony on the tiny island of Buldir (U.S. Fish and Wildlife Service 1982). Avian cholera is currently a major threat to the concentrations of Aleutian Canada geese in the Central Valley. This subspecies is particularly vulnerable to cholera outbreaks because most of the population overwinters in a small geographical area. Sport hunting also has added to the species' decline (U.S. Fish and Wildlife Service 1982).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan for the Aleutian Canada goose was approved by USFWS in 1978 and revised in 1982 (U.S. Fish and Wildlife Service 1982). The plan outlines three primary objectives to be achieved before considering delisting the species: to maintain the wild populations at or above 1,200 individuals, to reestablish self-sustaining breeding populations of 50 pairs or more on three former breeding areas other than Buldir Island, and to continue an active public relations program (U.S. Fish and Wildlife Service 1982).

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BALD EAGLE *(Haliaeetus leucocephalus)*

Legal Status. The bald eagle is listed as endangered under the California Endangered Species Act, as threatened under the federal Endangered Species Act, and as fully protected under the California Fish and Game Code. The bald eagle is also protected under the federal Bald and Golden Eagle Protection Act.

Historical and Current Distribution and Status. Historically, the bald eagle nested throughout California; however, the current breeding distribution is restricted primarily to the mountainous habitats in the northern quarter of the state, in the northern Sierra Nevada, Cascades, and northern Coast Ranges (California Department of Fish and Game 1992). Bald eagles winter at lakes, reservoirs, and along major river systems throughout most of central and northern California and in a few southern California localities.

By 1972, there were only 26 known active bald eagle territories in California. Presently, approximately 100 pairs of bald eagles nest in the state. Nesting remains primarily restricted to the northern part of the state, with concentrations of birds at Shasta Lake, Claire Engle Lake, Eagle Lake, and Lake Almanor, and on the Pit River between Lake Britton and Shasta Lake. Additionally, three pairs of bald eagles are known to nest on the floor of the Central Valley in Shasta and Tehama Counties. Another pair of bald eagles is known to nest at Eastman Lake (Chowchilla River) in Madera County. The species appears to be increasing in most portions of the state (California Department of Fish and Game 1992).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Bald eagles are resident in the North Sacramento Valley and Butte Basin Ecological Zones and winters or is a regular visitor in Cottonwood Creek, Colusa Basin, Yolo Basin, Feather River/Sutter Basin, American River Basin, Eastside Delta Tributaries, East San Joaquin Basin, West San Joaquin Basin, Sacramento-San Joaquin Delta, and Suisun Marsh/North San Francisco Bay Ecological Zones.

Life History and Habitat Requirements. Bald eagle nesting territories in California are found primarily in Ponderosa pine and mixed conifer forests. Bald eagle nest sites are always associated with a lake, river, or other large water body and are usually within 1 mile of water. Nests are usually constructed in a tree that provides an unobstructed view of the water body and that is almost always the dominant or codominant tree in the surrounding stand. Snags and dead-topped live trees are important habitat components in a bald eagle nesting territory, providing perch and roost sites.

Bald eagles winter along rivers, lakes, or reservoirs that support adequate fish or water bird prey and have mature trees or large snags available for perch sites. Bald eagles often roost communally during winter, typically in mature trees or snags with open branching structures that are isolated from human disturbance.

Reasons for Decline. Early declines in bald eagle populations have been attributed to human persecution and destruction of riparian, wetland, and coniferous forest habitats. The most important factor that contributed to the decline of bald eagle populations, however, was a reduction in reproductive success resulting from eggshell thinning caused by DDE (dichloro-diphenyl-dichloroethylene), a metabolite of the agricultural pesticide DDT.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. USFWS developed a recovery plan for the Pacific population of bald eagles in 1986. The status of the breeding population was considered the most important criterion for delisting the population. Numerical goals for wintering populations were not established in the recovery plan because of annual fluctuations in migration patterns and habitat use. Wintering habitat must be managed, however, to support existing populations and allow for the proposed increase in the bald eagle population.

Delisting would be considered on a regional basis if four criteria were met: a minimum of 800 pairs nested in the seven-state Pacific recovery area; the nesting pairs produced an average of at least one fledged young per pair, with an average success rate per occupied site of no less than 65% over a 5-year period; population recovery goals were being met in at least 80% of the management zone with nesting potential; and there was no persistent long-term decline in any sizable wintering population (greater than 100 birds).

Citation

California Department of Fish and Game. 1992. Annual report on the status of California state listed threatened and endangered animals and plants. Sacramento, CA.

CALIFORNIA BROWN PELICAN *(Pelecanus ocidentalis californicus)*

Legal Status. The California brown pelican is listed as endangered under the California and federal Endangered Species Acts and is designated as a fully protected species under the California Fish and Game Code.

Historic and Current Distribution and Status. Until the 1960s, thousands of brown pelican bred on Anacapa Island and other Channel Islands. A rapid decline of nesting success, resulting from the effects of DDT, led to a sharp reduction in the species' population. In 1970, there were only three young raised in California. Since the ban of DDT, numbers have begun to increase (Cogswell 1977). The brown pelican currently nests on the Channel Islands, Anacapa Island, Santa Barbara Island, and Santa Cruz Island. During summer and fall, brown pelicans can also be found at the Salton Sea, along the Lower Colorado River, and along the central and northern coast (Zeiner et al. 1990).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The brown pelican is present in the Suisun Marsh/North San Francisco Bay Ecological Zone but it does not breed there.

Life History and Habitat Requirements. The brown pelican occurs along the coast of California and can be found in estuarine habitats along the coast and on rocky islands off the coast. Pelican nests consist of arranged sticks on the ground (California Department of Fish and Game 1992); the species breeds between March and April, with birds present at nesting islands until early August (Zeiner et al. 1990). From Santa Barbara County north, the number of pelicans is low until May, when the number increases and peaks during summer months. There is also an influx of brown pelicans from Mexico from May until November (Small 1994). The predominate prey for the brown pelican is small fish such as anchovies, but the species will sometimes eat crustaceans and even carrion (Zeiner et al. 1990).

Reasons for Decline. The main reason for the past decline of the brown pelican was the accumulation of DDT in their bodies. This chemical (used as a pesticide) caused sterility in some and the thinning of eggshells for those able to breed, causing a near total failure of recruitment at nesting sites (Cogswell 1977). Periodic El Nino events have also contributed to the decline of this species (Small 1994). Potential oil spills in the Santa Barbara Channel, disturbance of post-breeding roosting sites, injury and death from fishing hooks and lines, and disease also pose serious threats to the brown pelican (California Department of Fish and Game 1992).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan was prepared in 1983. The plan recommended that the brown pelican be reclassified as threatened when a 5-year mean productivity of 0.7 occurs when there are at least 3,000 pairs and be considered for delisting when a 5-year mean productivity of 0.9 occurs when there are at least 3,000 pairs (California Department of Fish and Game 1992).

Citations

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CALIFORNIA CLAPPER RAIL *(Rallus longirostris obsoletus)*

Legal Status. The California clapper rail is state and federally listed as endangered under the California and federal Endangered Species Acts and as fully protected under the California Fish and Game Code.

Historical and Current Distribution and Status. Historically, the largest populations of California clapper rail occurred in saline emergent wetlands throughout south San Francisco Bay (Grinnell and Miller 1944). Smaller populations were present in marshes along the San Mateo coast and those adjacent to Monterey Bay and the Elkhorn Slough (U.S. Fish and Wildlife Service 1984). The historical distribution may have included coastal marshes of Humboldt and Morro Bays (Brooks 1940).

Overharvest by commercial and sport hunters led to the depletion of the California clapper rail by the early 1900s (U.S. Fish and Wildlife Service 1984). Protection from harvesting was afforded to the species through the establishment of the Migratory Bird Treaty Act of 1913. Clapper rail populations appeared to recover with protection; however, habitat loss accelerated in the early 1900s when marshes were converted to other uses (DeGroot 1927). By the late 1970s, more than 2,800 acres of marsh habitat had been lost.

The current distribution of the California clapper rail is restricted to San Francisco Bay, where as few as 300 individuals may occupy the remnant native marshes (California Department of Fish and Game 1992). Recently, California clapper rails have been seen in Suisun Marsh, an area historically not occupied by the species (U.S. Fish and Wildlife Service 1984). It is believed that the increased salinity of Suisun Marsh resulting from decreased flows from the Delta have allowed the clapper rail to expand into this area (U.S. Fish and Wildlife Service 1984). Over 90% of the population, however, is still found in south San Francisco Bay (California Department of Fish and Game 1992).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The California clapper rail is present in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. The California clapper rail occupies saline and brackish emergent wetlands. Vegetation in these wetlands is generally dominated by pickleweeds or cord grasses, both of which are used for nesting (U.S. Fish and Wildlife Service 1984). Clapper rail populations have declined in areas where alkali bulrushes dominate (U.S. Fish and Wildlife Service 1984).

Clapper rails nest from mid-March through July in the lower cord-grass-dominated marsh zones near networks of small tidal sloughs (DeGroot 1927, U.S. Fish and Wildlife Service 1984). These sloughs provide protected routes for movement and foraging for the adults and young (U.S. Fish and Wildlife Service 1984). Vegetation and drift material are used in the construction of a canopy over the platform nest (U.S. Fish and Wildlife Service 1984). Cord-grass habitat and associated nesting materials may provide more protection from high tides because of the ability of nests to float. Additionally, the uniform, dense cover of the cord grass may provide more protection

for young and adults than other more patchy upper marsh areas. During winter, clapper rails may be more widely distributed in the marshes and may use the upper marsh vegetation for cover, especially during extreme high tides (U.S. Fish and Wildlife Service 1984).

The California clapper rail feeds primarily on invertebrates; in south San Francisco Bay, the introduced horse mussel, spider clams, and yellow shore crabs are primary food items (Moffitt 1941).

Reasons for Decline. Loss of tidal marshes is the primary reason for the decline of the California clapper rail. Many of the remaining marshes lack extensive high marsh habitat and have steep earthen levees, making them unsuitable for clapper rails. Additionally, pollution from sewage effluent, industrial discharges, and urban runoff has contaminated the species' food sources. Predation on young and eggs by the introduced red fox may be responsible for the recent rapid decline of the clapper rail population in south San Francisco Bay.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. USFWS (1984) developed a recovery plan for the California clapper rail and the salt marsh harvest mouse. The objectives of the plan emphasize protection and enhancement of existing marshes and restoration of former habitat. The specific objectives are outlined under "Recovery Plan and Recovery Requirements" for the salt marsh harvest mouse.

The establishment of the San Francisco Bay National Wildlife Refuge has preserved approximately 40% of the remaining clapper rail habitat in south San Francisco Bay. The refuge contains many areas with high potential for marsh restoration. Potential habitat for the rail exists in Suisun Marsh.

Citations

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CALIFORNIA CONDOR *(Gymnogyps californianus)*

Legal Status. The California condor is listed as endangered under the California and federal Endangered Species Acts and is designated as a fully protected species under the California Fish and Game Code.

Historic and Current Distribution and Status. California condors were once widespread throughout western North America from British Columbia (Canada) to Baja California (Mexico) (California Department of Fish and Game 1992). After 1850, the species became rare north of California. The condor population declined until, by 1940, the species was restricted to only California (Koford 1953). All confirmed nest sites of the condor were located south of San Francisco and north of Baja California (Koford 1953).

By the 1980s, the California condor had been restricted to the Coast Ranges from northern Los Angeles County, San Luis Obispo County, and Tulare County in the western Sierra Nevada. In 1987, the last wild condor was captured for an intensive captive-breeding program. As of October 30, 1998, the total population was 150 birds; 104 in captivity and 46 in the wild. There are 25 condors around Vermillion Cliffs near the Grand Canyon (Arizona), five at Ventana/Big Sur (Monterey and San Luis Obispo Counties), and 16 at Lion Canyon/Castle Crags (Santa Barbara and Ventura Counties) (Los Angeles Zoo 1998).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The California condor is present in the West San Joaquin Basin Ecological Zone.

Life History and Habitat Requirements. The California condor can be found in mountains and surrounding grasslands where it can easily spot and approach carrion (Zeiner et al. 1990). They also require large trees and snags for roosting (Zeiner et al. 1990). Condors nest in caves, crevices, behind rock slabs, or on large ledges on high sandstone cliffs. Eggs are not laid in nests but on bare ground (Zeiner et al. 1990).

Reasons for Decline. Human activities, directly and indirectly, have been the greatest threat to the California condor's survival. Egg collecting, egg predation by ravens and other predators, poisons and contaminants, shooting, lead poisoning, energy development and human disturbance have lead to the significant decline of this species (California Department of Fish and Game 1992, California Condor Recovery Team 1994).

Designated Critical Habitat. Approximately 570,000 acres of critical habitat has been designated for the California condor in six southern California counties (Ventura, Los Angeles, Santa Barbara, San Luis Obispo, Kern, and Tulare Counties). None of these critical habitat areas are located in the CALFED Solution Area.

Recovery Plan and Recovery Requirements. To be completed.

Citations

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CALIFORNIA LEAST TERN *(Sterna antillarum browni)*

Legal Status. The California least tern is listed as endangered under the California and federal Endangered Species Acts and as a fully protected species under the California Fish and Game Code.

Historical and Current Distribution and Status. Historically, California least terns occurred throughout coastal regions south of Santa Cruz County. Currently, nesting populations can be found from San Luis Obispo County to San Diego County, with the greatest number of breeding pairs in Los Angeles, Orange, and San Diego Counties. One breeding colony occurs in the San Francisco Bay Area. California least terns are found in the state only during the breeding season (from April to September).

From 1970 to 1991, the estimated number of breeding pairs increased form 600 to 1,830. Acquisition of nesting areas by public agencies has contributed to better protection of existing colonies. Newly created shoreline areas have contributed to an increase in nesting habitat.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The least tern occurs in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. California least terns nest in colonies of 30–50 pairs on expansive stretches of shoreline and salt evaporation areas. They feed on a wide variety of small species of fish and other prey near the shore.

Reasons for Decline. Nesting colonies are disturbed by human activities in nesting areas and predation by American crows, American kestrels, and introduced species such as feral cats and red foxes. Near developed areas, native species that are tolerant of development (raccoons) exert an unnaturally high predation pressure. Off-road-vehicle use, coastal development, and other disturbances have played a major role in reducing available nesting habitat.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan for the California least tern was issued in 1980 that emphasized annual breeding-population surveys and site management and protection activities, including predator control and protection from human activities.

LEAST BELL'S VIREO *(Vireo bellii pusillus)*

Legal Status. The least Bell's vireo is listed as endangered under the California and federal Endangered Species Acts.

Historical and Current Distribution and Status. The least Bell's vireo's historical range once spread from interior northern California near Red Bluff (Tehama County) south through the Sacramento and San Joaquin Valleys, and in the Coast Ranges from Santa Clara County south to approximately San Fernando in Baja California (California Department of Fish and Game 1992).

The current breeding range is restricted to two intermittent localities in the Salinas River Valley (Monterey and San Benito Counties): one along the Armagosa River (Inyo County) and numerous small populations from southern California (primarily Santa Barbara, Riverside, Ventura, and San Diego Counties) into northwest Baja California.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The least Bell's vireo no longer occurs in any of the 14 ecological zones.

Life History and Habitat Requirements. This insectivorous species inhabits dense, willow-dominated riparian habitats with lush understory vegetation, which is limited to the immediate vicinity of watercourses. Unlike its other subspecies, the least Bell's vireo does not frequent upland sites and is especially vulnerable to the loss and fragmentation of riparian habitats (51 FR [85]:16474–16483, May 2 1986). It is a summer resident of the following riparian habitats: willow (Salix sp.), cottonwood (Populus fremontii) forests, oak (usually Quercus agrifolia) forests, shrubby thicket (often composed solely of willow species, usually narrowleaf willow, Salix dexigua or black willow, Salix gooddingii), and dry washes (with willow thickets at the edges to provide foraging habitat and nest sites) (California Department of Fish and Game 1992).

Reasons for Decline. Loss and fragmentation of willow-dominated riparian areas is the major cause of the decline of the least Bell's vireo. Brood parasitism by the brown-headed cowbird has also contributed to the decline of this species (California Department of Fish and Game 1992).

Designated Critical Habitat. The U.S. Fish and Wildlife Service (USFWS) has designated 38,000 acres in 10 localities in six counties in southern California as critical habitat for this species (59 FR 4845, February 2, 1994).

Recovery Plan and Recovery Requirements. A draft recovery plan has been prepared by USFWS (U. S. Fish and Wildlife Service 1998). The objective of the draft recovery plan is to delist the least Bell's vireo. Actions identified in the recovery plan to achieve this objective include: 1) protect and manage riparian and adjacent upland habitats within the least Bell's vireo historical range, 2) conduct research to determine the current status of the species and its habitat within its current range and to identify its ecological requirements, 3) develop and evaluate methods for restoring or enhancing habitat for the species, 4) establish additional populations within the species' historical range, 5) evaluate the progress of recovery, effectiveness of management and recovery actions, and revise management plans, and 6) provide public information and education.

Citations

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NORTHERN SPOTTED OWL *(Strix occidentalis caurina)*

Legal Status. The northern spotted owl is listed as threatened under the federal Endangered Species Act.

Historical and Current Distribution and Status. Historically, the range of the northern spotted owl extended throughout the mountains of northwestern California, western Oregon, western Washington, and southwestern British Columbia (Guttierrez et al. 1995). In California, the northern spotted owl's range extends east to western Modoc County, south to Marin County, and north to the Oregon Border. The current distribution of the northern spotted owl is similar to the historical range where forested habitat still exists.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The northern spotted owl is present in the Suisun Marsh/North San Francisco Bay, Colusa Basin, Cottonwood Creek Basin, Sacramento River, and the Northern Sacramento Valley Ecological Zones.

Life History and Habitat Requirements. Northern spotted owls generally select mature and old-growth forest for habitat use (Forsman 1980; Forsman et al. 1984; Solis and Gutierrez 1990; Sisco 1990; Carey 1990, 1992). They have been found in the following forest types: Douglas-fir, western hemlock, grand fir, white fir, ponderosa pine, and Shasta red fir (Forsman et al. 1984).

Northern spotted owls nest almost exclusively in trees, and the majority of egg laying occurs in April (Forsman et al. 1984). Annual variation in breeding may be related to weather conditions and fluctuations in prey abundance (Zabel et al. 1996). The primary causes of mortality in northern spotted owls are starvation and predation by great horned owls and goshawks (Forsman et al. 1984). Spotted owls are perch-and-pounce predators that feed mainly on small and medium-size mammals (Marshall 1942, Forsman 1976, Barrows 1980, Solis 1983, Forsman et al. 1984, Barrows 1987, Carey 1990, Thomas 1990).

Reasons for Decline. Loss of habitat from heavy logging is the primary reason for the decline of the northern spotted owl. Additionally, because of their specificity for certain kinds of habitat, low fecundity, long life span, and negative response to fragmentation and habitat loss, they are more likely to be negatively affected following extensive habitat disturbance (Forsman et al. 1984, Forsman 1988, Carey et al. 1992, Johnson 1992).

Designated Critical Habitat. The Cottonwood Creek Ecological Zone has been designated as critical habitat for the northern spotted owl.

Recovery Plan and Recovery Requirements. A recovery plan for the species has been prepared by the U.S. Fish and Wildlife Service (57 FR 1796–1838, January 15 1992).

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WESTERN SNOWY PLOVER *(Charadrius alexandrinus nivosus)*

Legal Status. The western snowy plover (coastal populations) is listed as threatened under the federal Endangered Species Act, designated as a species of special concern by the California Department of Fish and Game (DFG), and designated a migratory nongame bird of management concern by the U.S. Fish and Wildlife Service (USFWS). The inland populations of the western snowy plover is designated as a species of special concern by DFG and as a migratory nongame bird of management concern by USFWS.

Historical and Current Distribution and Status. Historical records suggest that nesting western snowy plovers were once more widely distributed in coastal California. In coastal California, snowy plovers nested at 53 locations before 1970 (Page and Stenzel 1981). Since then, no evidence of breeding birds has been found at 33 of these 53 sites, which represents a 62% decline (Page and Stenzel 1981).

The western snowy plover's current distribution in California is along the coast from Oregon to Mexico and near lakes in the drier interior portions of California. In 1980, the adult population was estimated at 3,408 individuals; by 1989 it was estimated at 3,031. The largest coastal breeding population of this species is found around the San Francisco Bay; the largest inland breeding populations are found around Owens Lake (Inyo County) and Alkali Lake (Modoc County) (Small 1994).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The western snowy plover occurs as a nesting species in the Suisun Marsh/North San Francisco Bay, Yolo Basin, and West San Joaquin Basin Ecological Zones.

Life History and Habitat Requirements. The coastal populations nest on sandy beaches above the upper limits of normal tides. The inland populations nest around the shores of alkali lakes and along dikes of saltponds (Grinnell and Miller 1944). There are nesting sites scattered along the coast from the Oregon border to San Diego County, as well as along many inland lakes and saltponds and on the Channel Islands (Remsen 1978). Western snowy plovers nest from April to August. Nests are built by digging a depression in the sand and lining it with shells and other debris (Zeiner et al. 1990). Western snowy plovers feed on arthropods in the dry sands of the upper beach, rarely foraging in the wet sand, and primarily on brine flies around saltponds and alkali lakes (Cogswell 1977).

Reasons for Decline. Human activity around nesting sites is the major reason for this species' decline. Almost every beach that has suitable habitat shows signs of human disturbance, especially by off-road vehicles (Remsen 1978). Several lakes in the San Joaquin Valley were drained and converted to farmland, which contributed to the loss of foraging and nesting habitat.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

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Small, A. 1994. California birds: their status and distribution. Ibis Publishing Company. Vista, CA.

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ALAMEDA WHIPSNAKE *(Masticophis lateralis euryxanthus)*

Legal Status. The Alameda whipsnake is listed as threatened under the California and federal Endangered Species Acts and as a fully protected species under the California Fish and Game Code.

Historical and Current Distribution and Status. The Alameda whipsnake historically occurred and currently occurs in Alameda and Contra Costa Counties (California Department of Fish and Game 1992). There are five remaining populations with little or no genetic flow between them. These populations are:

(1) Sobrante Ridge, from the Tilden/Wildcat Regional Parks area to the Briones Hills, in Contra Costa County (Tilden-Briones population);

(2) Oakland Hills, from the Anthony Chabot area to Las Trampas Ridge, in Contra Costa County (Oakland-Las Trampas population);

(3) Hayward Hills, from the Palomares area to Pleasanton Ridge, in Alameda County (Hayward-Pleasanton Ridge population);

(4) Mount Diablo vicinity and the Black Hills, in Contra Costa County (Mount Diablo-Black Hills population); and

(5) Wauhab Ridge, from the Del Valle area to the Cedar Mountain Ridge, in Alameda County (Sunol-Cedar Mountain population) (62 FR 64306, December 5, 1997).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The Alameda whipsnake occurs year round in the West San Joaquin Basin and Suisun Marsh/North San Francisco Bay Ecological Zones.

Life History and Habitat Requirements. The Alameda whipsnake can occur in any inner Coast Range plant community, including chaparral, grasslands, open woodlands, on rocky slopes, and along open streams and arroyos (California Department of Fish and Game 1992). The mating season for the species is March through June; males and females mate near the hibernacula of the female (62 FR 64306, December 5, 1997).

Reasons for Decline. The primary cause of the decline of the Alameda whipsnake is the loss of habitat from human activities and the alteration of suitable habitat from fire suppression and the resulting increased likelihood of catastrophic wildfires. Habitat fragmentation from urban development and associated highway and road development has led to genetic isolation of most populations. (62 FR 64306, December 5, 1997.)

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citation

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

BLUNT-NOSED LEOPARD LIZARD *(Gambelia silus)*

Legal Status. The blunt-nosed leopard lizard is listed as endangered under the California and federal Endangered Species Acts and as a fully protected species under the California Fish and Game Code.

Historical and Current Distribution and Status. The blunt-nosed leopard lizard was historically found throughout the San Joaquin Valley and adjacent foothills from San Joaquin County to eastern San Luis Obispo County (California Department of Fish and Game 1992). Blunt-nosed leopard lizard habitat was reduced from 228,000 acres to 158,000 acres between 1976 and 1980 (California Department of Fish and Game 1992). The species currently occupies isolated and scattered areas of undeveloped habitat on the San Joaquin Valley floor and in the eastern foothills of the Coast Range (California Department of Fish and Game 1992).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The blunt-nosed leopard lizard is a resident species in the East San Joaquin Basin and West San Joaquin Basin Ecological Zones.

Life History and Habitat Requirements. Blunt-nosed leopard lizards are found in sparsely vegetated plains, alkali flats, grasslands, low foothills, canyon floors, and large washes (California Department of Fish and Game 1988). They inhabit areas with sandy soils and scattered vegetation and are usually absent from thickly vegetated habitats (California Department of Fish and Game 1992). The mating season for the blunt-nosed leopard lizard is from late April through May (Zeiner et al. 1988). Breeding females can be identified by the orange or reddish spots on their sides (California Department of Fish and Game 1992). Blunt-nosed leopard lizards feed on a variety of insects, as well as on other small lizards, and have been known to be cannibalistic (Zeiner et al. 1988).

Reasons for Decline. Almost all of the suitable habitat in the San Joaquin Valley has been eliminated or fragmented by agricultural development and urbanization (California Department of Fish and Game 1992, U.S. Fish and Wildlife Service 1997). The use of agricultural pest control programs, which eliminate insect prey; intensive grazing; and petroleum and mineral extraction have also contributed to the decline of the blunt-nosed leopard (U.S. Fish and Wildlife Service 1997).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan was first prepared by the USFWS in 1980 and revised in 1985 (U.S. Fish and Wildlife Service 1985). Reclassification of the species as threatened may be considered when sufficient acreage has been secured to maintain self-sustaining populations of blunt-nosed leopard lizard on the San Joaquin Valley floor. Approximately 30,000 acres of habitat in the San Joaquin Valley should be secured, with acquisition emphasis on optimal habitats containing comparatively high-density lizard populations. Populations will be collectively managed to meet or exceed a minimum average density of one lizard per acre. Delisting of this species may be possible when adjacent foothills and plains habitats of sufficient size to maintain self-perpetuating populations have also been secured (U.S. Fish and Wildlife Service 1985).

As part of the federal recovery plan, approximately 8,065 acres habitat are currently preserved, including the state-owned Alkali Sink Ecological Preserve (445 acres) in Fresno County and the Allensworth State Park (593 acres), Prairie Wildflower Preserve (4,809 acres), Voice of America transmitter site (630 acres), U.S. Forest Service Horse Pasture (790 acres), and Pixley National Wildlife Refuge (5,125 acres) in Tulare County. (U.S. Fish and Wildlife Service 1985.)

Citations

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Zeiner, D. C., W. F. Laudenslayer, Jr., K. E. Mayer (eds.). 1988. California's Wildlife: volume 2: amphibians and reptiles. California Department of Fish and Game. Sacramento, CA.

GIANT GARTER SNAKE *(Thamnophis gigas)*

Legal Status. The giant garter snake is listed as threatened under the California and federal Endangered Species Acts.

Historical and Current Distribution and Status. Historically, the giant garter snake was found throughout the Central Valley, from Butte County south to Kern County. Habitat loss resulting from wetland reclamation and agricultural development extirpated the giant garter snake from the southern one-third of its range from the 1940s to 1950s (Hansen and Brode 1980). Presently, populations of the snake are limited to ponds, sloughs, marshes, and rice fields of Sacramento, Sutter, Butte, Colusa, and Glenn Counties, although remnant populations exist along the western border of the Yolo Bypass in Yolo County and along the eastern fringes of the Delta from the Laguna Creek-Elk Grove region of Sacramento County south to Stockton, San Joaquin County (Hansen 1986; 58 FR 54053, October 20, 1993). The U.S. Fish and Wildlife Service (USFWS) recognized the existence of 13 populations of giant garter snake (58 FR 54053, October 20, 1993). Some populations may not be viable because they are small, highly fragmented, and restricted to small patches of habitat of limited quality. Populations in the Colusa, Butte, Sutter, and American River basins are associated with rice production and occupy the agricultural water delivery and drainage ditches (58 FR 54053, October 20, 1993). The largest extant population inhabits the water channels and ditches of agricultural lands in the American River basin at the confluence of the American and Sacramento Rivers (58 FR 54053, October 20, 1993).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The giant garter snake is present in the Butte Basin, Feather River/Sutter Basin, Colusa Basin, Yolo Basin, American River Basin, Eastside Delta Tributaries, Sacramento-San Joaquin Delta, East San Joaquin Basin, and West San Joaquin Basin Ecological Zones.

Life History and Habitat Requirements. The giant garter snake is endemic to emergent wetlands in the Central Valley. The species' habitat includes marshes; sloughs; ponds; small lakes; and low-gradient waterways, such as small streams, irrigation and drainage canals, and rice fields (58 FR 54053, October 20, 1993). The giant garter snake requires adequate water with herbaceous, emergent vegetation for protective cover and foraging habitat. Primary food items include fish, tadpoles, and frogs (Hansen and Brode 1980). Open areas and grassy banks are needed for basking. Small mammal burrows and other small crevices at higher elevations provide winter hibernation sites and refuge from floodwaters (58 FR 54053, October 20, 1993).

All three habitat components (cover and foraging habitat, basking areas, and protected hibernation sites) are needed. Because of their lack of basking areas and the lack of prey populations, riparian woodlands usually do not support the giant garter snake (Hansen and Brode 1980). Additionally, because of predation by introduced fish, larger rivers generally do not support the snake (58 FR 54053, October 20, 1993).

Reasons for Decline. Habitat loss to agricultural development has been the primary factor in the decline of giant garter snake populations. Small remaining populations are susceptible to

predation by fish, mammals, and birds. Additional causes of mortality include vehicular traffic, agricultural practices, and maintenance of water channels.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

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CALIFORNIA RED-LEGGED FROG *(Rana aurora draytoni)*

Legal Status. The California red-legged frog is listed as threatened under the federal Endangered Species Act and is a California species of special concern.

Historical and Current Distribution and Status. The California red-legged frog was found in scattered populations throughout much of lowland California west of the Sierra Nevada. The species' range extended from coastal Marin County; inland into Shasta County, and south into northwestern Baja California, Mexico (57 FR 45761, October 5, 1992). Habitat loss has resulted in the species' extirpation from approximately 75% of its historical range (57 FR 45761, October 5, 1992), including the floor of the Central Valley and probably more than one-half of the drainage systems in the valley (Hayes and Jennings 1986). There are only three areas now known to support large breeding populations (≥350 adults) of the California red-legged frog: Pescadero Marsh Nature Reserve, San Mateo County; Point Reyes National Seashore, Marin County; and Rancho San Carlos, Monterey County (57 FR 45761, October 5, 1992). Other breeding localities include the Los Vaqueros area in Alameda County, Webber Creek in El Dorado County, and Plumas County.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The California red-legged frog is found in the West San Joaquin Basin, Eastside Delta Tributaries, and Feather River/Sutter Basin Ecological Zones.

Life History and Habitat Requirements. California red-legged frogs require cold pond habitats (including stream pools and stockponds) with emergent and submergent vegetation (Storer 1925). Habitats with the highest densities of frogs are deepwater ponds (at least 3 feet deep) with dense stands of overhanging willows and a fringe of cattails (Jennings 1988, Hayes and Jennings 1988). Red-legged frogs occur most frequently in intermittent waters that lack fish and bullfrogs (Hayes and Jennings 1988).

California red-legged frogs lay their eggs in clusters around aquatic vegetation from December to early April. The larvae require approximately 3–5 months to complete metamorphosis (Storer 1925). Adults are highly aquatic when active, but are less dependent on permanent water bodies than other frog species (Brode and Bury 1984). Adults may estivate during dry periods in rodent holes or cracks in the soil (Hansen pers. comm.).

Reasons for Decline. The causes of the red-legged frog's decline are poorly understood (Hayes and Jennings 1986); however, several factors have probably contributed to their decline, including overharvest, habitat loss, and an increase in introduced fish and bullfrog populations. Specific areas, such as the San Joaquin Valley, were particularly affected by wetland reclamation and species harvest (Jennings and Hayes 1984). The continued loss of wetland habitats threatens remaining populations.

The number of permanent ponds located in the Central Valley below an elevation of 4,500 feet has increased (Moyle 1978); however, most red-legged frogs are restricted to intermittent waters. Hayes and Jennings (1988) suggested that this restriction is the result of the introduction of

non-native fishes and bullfrogs to wetland habitats with permanent water. Introduced fishes and bullfrogs prey on red-legged frog larvae and adults and compete with them for food.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

Printed References

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DELTA SMELT *(Hypomesus transpacificus)*

Legal Status. The delta smelt is listed as threatened under the California and federal Endangered Species Acts.

Historical and Current Distribution and Status. Delta smelt are found mainly in the waters of the Delta and Suisun Bay, but are generally most abundant in the western Delta and eastern Suisun Bay (Honkers Bay). Their spawning distribution varies from year to year within the Delta. The species is endemic to the Sacramento-San Joaquin estuary and its population abundance varies substantially from year to year. Abundance has been uncharacteristically low since 1982, in large part because of the extended drought of 1987–1992 and possibly to extremely wet years in 1983 and 1986 (Moyle et al. 1989). Population abundance has fluctuated recently from increases in some years to uncharacteristic decreases in other years (Interagency Ecological Program 1998).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Delta smelt are confined primarily to the Delta and Suisun Marsh/San Francisco Bay Ecological Zones. They appear to move upstream from Suisun Bay into the Delta in winter and spring to spawn. After early rearing in the Delta, they tend to move downstream to low-salinity habitats in the western Delta (particularly in drier years) and Suisun Bay (in both wet and dry years). Small populations also occur in the Napa River estuary and Suisun Marsh.

Life History and Habitat Requirements. Delta smelt are small, plankton-feeding fish that usually live for only 1 year. In most years, delta smelt spawn primarily in the upper end of Suisun Bay, in Montezuma Slough, and in the northern and central Delta. In the Delta, they spawn mostly in the Sacramento River channel, central Delta, and adjacent sloughs (59 FR 852, January 6, 1994). Delta smelt typically spawn from February through May and spawning is believed to take place primarily in shallow edgewaters and river areas under tidal influence with moderate to fast velocities (Wang 1991). Approximately 2 parts per thousand salinity, or the area just upstream of it, is the principal habitat of delta smelt larvae and young juveniles (Herbold et al. 1992, Jassby 1993).

Reasons for Decline. Factors that contribute to low abundance relative to historical conditions include change in flow patterns; entrainment in diversions; contaminants; and species interactions, particularly competition and predation associated with establishment of non-native species (Stevens et al. 1990, Herbold et al. 1992). Although effects of contaminants have not been specifically described for delta smelt, pesticides have been found in the Sacramento River in recent years at concentrations potentially harmful to fish larvae (Herbold et al. 1992). Recent bioassays by the Central Valley Regional Water Quality Control Board indicate that water in the Sacramento

River is periodically toxic to larvae of the fathead minnow, a standard U.S. Environmental Protection Agency (USEPA) test organism (Stevens et al. 1990).

Food availability may be an important factor affecting survival of delta smelt larvae. Abundance of rotifers and phytoplankton has declined in recent years (Obrebski et al. 1992). Rotifers are small and may be important to the diet of larval delta smelt (California Department of Water Resource and U.S. Bureau of Reclamation 1993) and other fish larvae (Hunter 1981).

Designated Critical Habitat. Critical habitat for delta smelt includes the areas of all waters and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay; the length of Goodyear, Suisun, Cutoff, First Mallard, and Montezuma sloughs; and the existing contiguous waters contained within the Delta.

Recovery Plan and Recovery Requirements. USFWS (1996) developed a recovery plan for delta smelt, the objective of which is to manage the estuary in such a way that it is a better habitat for native fish in general and delta smelt in particular. Recovery is tied to increased abundance and distribution within the Bay and Delta. Improved habitat conditions will allow delta smelt to be widely distributed throughout the Delta and Suisun Bay.

Citations

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SACRAMENTO SPLITTAIL *(Pogonichthys macrolepidotus)*

Legal Status. The Sacramento splittail is listed as threatened under the federal Endangered Species Act and is a California species of special concern.

Historical and Current Distribution and Status. Endemic to Central Valley lakes and rivers, adult splittail now primarily inhabit the Delta and Suisun Bay and Marsh (Moyle et al. 1995). The species' distribution has been reduced to less than one-third of its original range (59 FR 862, January 6, 1994). Fish surveys in the Sacramento-San Joaquin estuary indicate that splittail abundance there had declined by over 50% from 1980 through 1994, most likely in response to the drought of 1987–1992 (Meng and Moyle 1995, Sommer et al. 1997). In 1995, abundance reached a record high, relative to historical conditions (Sommer et al. 1997). Strong year classes follow high flow years (i.e., 1995), when portions of the estuary and river floodplains are flooded in winter and early spring. Preliminary surveys in 1998 indicated high larvae and juvenile abundance during this very wet year (California Department of Fish and Game 1998).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Splittail are found in all the ecological zones of the Central Valley except the West San Joaquin Basin Ecological Zone. Adults and juveniles live in the Bay and Delta ecozones and migrate upstream during winter and spring. Adults are found in river ecozones generally from early winter through spring. Most young move out of upstream spawning and rearing habitat in spring and early summer.

Life History and Habitat Requirements. Splittail are estuarine fish capable of tolerating moderate levels of salinity from 10–18 parts per thousand. Splittail typically spawn in dead-end sloughs and slow reaches of large rivers and river floodplains over submerged vegetation. Spawning occurs primarily in the lower river reaches and flood bypasses of the Sacramento and San Joaquin Rivers. Shallow, weedy areas inundated during seasonal flooding provide habitat for adult spawning and foraging and subsequent egg development and larval and early juvenile rearing. As flooded habitat disappears, larvae and juveniles use habitat along the margins of the main river and Delta channels. Although splittail use deeper, open water as they grow, much of the population continues to use shallow (<10 feet) edge habitat as adults (Meng and Moyle 1995). Juvenile splittail are commonly found in Delta sloughs in late winter and spring and are particularly abundant in the vicinity of Montezuma Slough. As summer progresses, juvenile splittail occupy the deeper, open-water habitats of Suisun and San Pablo Bays.

Reasons for Decline. The human-caused factor that has had the greatest effect on the abundance of splittail is loss and degradation of floodplain and marsh habitat (California Department of Fish and Game 1992). Land reclamation, flood control practices, and agricultural development have eliminated and drastically altered much of the ephemeral and perennial shallow-water habitats in the lowland areas available to spawning adults, larvae, and juveniles. An estimated 96% of historical wetland habitats are either unavailable to splittail or have been eliminated (50 CFR 17). Splittail abundance is positively associated with high Delta outflows during primary spawning months (March through May) (California Department of Fish and Game 1992, Sommer et al. 1997). High Delta outflows during late winter and spring correlate with increased total surface area of shallow-water habitats containing submerged vegetation (used by spawning adults), both within and

upstream of the Delta. During years of low riverflow, such as the 1986–1992 drought, spawning success may be greatly reduced, contributing to reduced adult abundance.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. USFWS (1996) developed a recovery plan for the reduced population of splittail. The objective of the plan is to 1) create meander belts along the Sacramento River by setting levees back; 2) create and reconnect wetlands to the floodplain in the lower San Joaquin, Tuolumne, and Stanislaus Rivers; 3) restore marsh habitat in the Delta and Suisun Marsh: 4) manage bypasses for fish; and 5) remove upstream barriers to migration.

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TIDEWATER GOBY *(Eucyclogobius newberryi)*

Legal Status. Tidewater goby is listed as endangered under the federal Endangered Species Act and is a California species of special concern.

Historical and Current Distribution and Status. Tidewater goby is discontinuously distributed throughout California, ranging from the mouth of the Smith River in Del Norte County south to Agua Hedionda Lagoon in San Diego County. Areas of precipitous coastlines that preclude the formation of lagoons at stream mouths have created three natural gaps in the distribution of the goby: 1) Humboldt Bay to Ten Mile River, 2) Point Arena to Salmon Creek, and 3) Monterey Bay to Arroyo del Oso.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Tidewater goby historically occurred in suitable habitat within the Suisun Marsh/North San Francisco Bay Ecological Zone, but are now considered extinct from the zone.

Life History and Habitat Requirements. Tidewater gobies inhabit coastal lagoons, creeks, and brackish marsh habitats, doing best in shallow slackwater areas. They are most abundant in the upper end of lagoons created by small coastal streams and are usually blocked from the ocean by sand bars, seldom subject to tidal fluctuations. In the streams, tidewater gobies occupy mostly slow-moving areas or pools away from the main current, among emergent and submerged vegetation.

Gobies spawn over coarse sand in winter and spring (typically from April through May, although gravid females have been found in January and February [Moyle 1976]). The tidewater goby is capable of tolerating a wide range of salinity, from fresh water to saltwater, and water temperatures as high as 73°F (Moyle et al. 1989). The tidewater goby is short-lived and typically requires shallow-water habitats with slow water velocities, high dissolved-oxygen levels, sand and mud substrates, and emergent and submergent vegetation (Moyle et al. 1989). The tidewater goby is able to complete its entire life cycle in fresh or brackish water (Wang 1982, Swift et al. 1989).

Reasons for Decline. Although widely distributed, tidewater goby populations appear to be declining in response to habitat degradation, such as upstream water diversions, pollution, siltation, and urban development of surrounding lands. Habitat degradation, coupled with the effects of the recent drought and the tidewater goby's relatively short life span (approximately 1 year), have contributed to the decline in the species' abundance throughout California.

Designated Critical Habitat. None

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

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CALIFORNIA FRESHWATER SHRIMP *(Syncaris pacifica)*

Legal Status. The California freshwater shrimp is listed as endangered under the California and federal Endangered Species Acts.

Historical and Current Distribution and Status. Before human disturbances, the California freshwater shrimp is assumed to have been common in low-elevation, perennial freshwater streams within Marin, Sonoma, and Napa Counties. Today, the shrimp is found in perennial to semiperennial streams below an elevation of 200 meters in Sonoma, Marin, and Napa Counties. Sixteen isolated populations are known. The distribution of the shrimp can be separated into four general geographic regions: 1) tributary streams in the lower Russian River drainage, which flow westward into the Pacific Ocean; 2) coastal streams flowing westward directly into the Pacific Ocean; 3) streams draining into Tamales Bay; and 4) streams flowing southward into northern San Pablo Bay.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The California freshwater shrimp occurs in suitable habitat in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. The California freshwater shrimp has evolved to survive a broad range of stream and water temperature conditions characteristic of small, low-gradient (generally less than 1%), perennial coastal streams. California freshwater shrimp require water year round, and do best in slow to still instream pools where vegetation is prevalent, although they will also occur in small unvegetated stream pools isolated by summer droughts.

California freshwater shrimp use undercut banks with willow (Salix sp.) or blackberry (Rubus sp.) roots in the water or dense pool margins of cattails (Typha sp.), and generally occupy areas with a specific amount of canopy (Eng 1981; Serpa 1986, 1991). Excellent habitat conditions for the shrimp include streams 12–36 inches deep with exposed live roots (e.g., alder [Alnus sp.] and willow trees along undercut banks [more than 6 inches] with overhanging stream vegetation and vines) (Serpa 1991).

California freshwater shrimp breed at 1.5 years old in September and October, and females carry 50 to 200 eggs on their swimming legs through winter. Young shrimp hatch and leave the parent in spring.

Reason for Decline. Stream channelization, deterioration or loss of habitat resulting from water diversion, impoundments, livestock and dairy activities, agricultural activities and development, flood control activities, gravel mining, timber harvesting, migration barriers, water pollution, and introduced predatory fish have eliminated the California freshwater shrimp from six streams since 1975.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan for the California freshwater shrimp has been prepared by USFWS (U.S. Fish and Wildlife Service 1997) and is currently being revised.

Citations

Eng, L. L. 1981. Distribution, life history, and status of the California freshwater shrimp, Syncaris pacifica (Holmes). California Department of Fish and Game. Inland Fisheries Endangered Species Program Special Publication 81-1. 27 p. Sacramento, CA.

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U.S. Fish and Wildlife Service. 1997. Draft California Freshwater Shrimp Recovery Plan. Sacramento, CA.

CALLIPPE SILVERSPOT BUTTERFLY *(Speyeria callippe callippe)*

Legal Status. The callippe silverspot butterfly is listed as endangered under the federal Endangered Species Act (62 FR 6430; December 5, 1997).

Historical and Current Distribution and Status. Seven populations of the callippe silverspot butterfly were historically known from the San Francisco Bay region. The historical range of the callippe silverspot butterfly includes the inner Coast Range on the eastern shore of San Francisco Bay from northwestern Contra Costa County south to the Castro Valley area in Alameda County. On the west side of the Bay, the species ranged from San Francisco south to the vicinity of La Honda in San Mateo County. Five colonies, including one located at Twin Peaks in San Francisco, were extirpated. The remaining colonies exist on mostly privately owned land, but also on city-, county-, and state-owned land. The callippe silverspot does not occur north of the Golden Gate or Carquinez Straits. Currently, extant colonies are known only from San Bruno Mountain in San Mateo County and a city park.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The callippe silverspot butterfly occurs in suitable habitat in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. The callippe silverspot butterfly is found in native grassland and adjacent habitats (Steiner 1990, Thomas Reid Associates 1982). The females lay their eggs on the dry remains of the larval host plant, Johnny jump-up (Viola pedunculata), or on the surrounding debris (Arnold 1981, Thomas Reid Associates 1982). After about a week, the larvae hatch and eat the egg shell. The larvae are dark-colored with many branching sharp spines on their backs. The caterpillars wander a short distance and spin a silk pad on which they spend summer, autumn, and winter in diapause. On termination of diapause in spring, the caterpillars immediately seek out the host plant. After having gone through five instars (i.e., growth stages), the larvae pupate within a chamber of leaves that they have drawn together with silk. Pupation usually occurs in May. The adults emerge in about 2 weeks and live for approximately 3 weeks. Depending on environmental conditions, the flight period of this single-brooded butterfly ranges from mid-May to late July. The adults exhibit hilltopping behavior, a phenomenon in which males and females seek a topographic summit to mate.

Specific habitat requirements have been withheld by the U.S. Fish and Wildlife Service (USFWS) in an effort to reduce pressure from collectors; however, the callippe silverspot butterfly does require habitat that is suitable for the host plant and topographic summits for mating sites.

Reason for Decline. The primary cause of the decline of the callippe silverspot butterfly is the loss of habitat from human activities. The species is imperiled by the current and potential future destruction and alteration of its habitat from off-road-vehicle use, trampling by hikers and equestrians, unsuitable levels of livestock grazing, and invasive non-native vegetation. Off-road vehicles and human or horse trampling pose threats to the colonies because these activities could crush the host plants of the larvae or the adult nectar sources.

The callippe silverspot butterfly was once widespread in the San Francisco Bay Area. At least five populations of this species have been eliminated by urban development and other causes. Although the majority of the natural areas on San Bruno Mountain have been preserved and will remain undeveloped in perpetuity, collection of specimens by amateur lepidopterists poses a threat. Use of insecticides may also be a problem.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

Arnold, R. A. 1981. A review of endangered species legislation in the U.S.A. and preliminary research on six endangered California butterflies (Lepidoptera, Lycaenidae). Beh. Ver. Nat. Landsch. Bad.-Wurtt. Karl. 21:79–96.

Steiner, J. 1990. Bay Area butterflies; the distribution and natural history of San Francisco region rhopalocera. Master's thesis. California State University at Hayward. 307pp.

Thomas Reid Associates. 1982. Final report to the San Mateo County Steering Committee for San Bruno Mountain. Endangered Species Survey San Bruno Mountain. Biological Study: 1980–1981. Palo Alto, CA.

CONSERVANCY FAIRY SHRIMP *(Branchinecta conservatio)*

Legal Status. The Conservancy fairy shrimp is listed as endangered under the federal Endangered Species Act.

Historical and Current Distribution and Status. The Conservancy fairy shrimp is endemic to California Central Valley grassland vernal pools. The species has an elevation range of between 16.4 and 476 feet. Population distribution is limited within this range to Vina Plains in Butte County, the Jepson Prairie Reserve in Solano County, the Sacramento Wildlife Refuge in Glenn County, and Haystack Mountain in Merced County (Eng et al. 1990). There is one unconfirmed population from Ventura County on Matau Flat Road approximately 6.8 miles south of Stauffer, California (Fugate 1992).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The Conservancy fairy shrimp is found in the Butte Basin, the Yolo Basin, and Colusa Basin Ecological Zones.

Life History and Habitat Requirements. The Conservancy fairy shrimp occurs in large, clay-bottomed vernal pools. Average depth of occupied ponds is approximately 7.8 inches. Specimens have been collected from poorly vegetated, turbid pools from November to early April (Eng et al. 1990). The Conservancy fairy shrimp matures within 36.5 days, takes 46.2 days to reproduce, and has a lives for about 113.9 days (Helm 1998).

Reasons for Decline. The Conservancy fairy shrimp has declined in its range throughout the California Central Valley from loss of habitat resulting from agricultural development (Eng et al. 1990).

Designated Critical Habitat. The Conservancy fairy shrimp does not have a designated critical habitat.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

Eng, L. L., D. Belk, and C. H. Eriksen. 1990. California anostraca: distribution, habitat, and status. Journal of Crustacean Biology 10(2): 247–277.

Fugate, M. L. 1992. Speciation in the fairy shrimp genus Branchinecta (Crustacea: Anostraca) from North America. Doctoral thesis. University of California. Riverside, CA.

Helm, B. 1998. Biogeography of eight large branchiopods endemic to California. Ecology, Conservation, and Management of Vernal Pool Ecosystems. Proceedings from a 1996 Conference. 19–21 June, 1996, pp124–139.

DELTA GREEN GROUND BEETLE *(Elaphrus viridus)*

Legal Status. The delta green ground beetle is listed as threatened under the federal Endangered Species Act.

Historical and Current Distribution and Status. The delta green ground beetle's historical distribution is largely unknown, although it is believed to have once been widely distributed over the wetland and grassland habitat of the California Central Valley. Currently, this beetle is known from only two sites in Solano County, California, south of Dixon at the Jepson Prairie Preserve (Jones and Stokes file information).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The delta green ground beetle occurs in the Yolo Basin Ecological Zone.

Life History and Habitat Requirements. Delta green ground beetle habitat is disputed. Some entomologists suggest that its habitat is mainly dense vegetation, while others suggest that it can be found mostly in more open habitats, including open borders of vernal pools. It has been found among Erodium sp. and other low-growing plants (Arnold 1983). Behavioral data on the delta green ground beetle is limited, but available information indicates that adult activity begins in February and continues until mid-May, when it enters a period of dormancy. E. viridis most likely has only one generation per year (Arnold 1983). Adults tend to be diurnal and are active during the warmest time of the day. Observations suggest that activity may be dependent on minimal wind and ambient temperatures.

Reasons for Decline. The delta green ground beetle has declined from agricultural, urban, and industrial development of California wetland habitat (Jones and Stokes file information).

Designated Critical Habitat. The delta green ground beetle's critical habitat is located in two areas of Solano County along the open borders of vernal pools on the Jepson Prairie Preserve.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citation

Arnold, R. A. 1983. Biological studies of the delta green ground beetle, Elaphrus viridus horn (Coleoptera: Carabidae), at Jepson Prairie Preserve in 1983. A contracted research project for the California field office of The Nature Conservancy.

LANGE'S METALMARK BUTTERFLY *(Apodemia mormo langei)*

Legal Status. Lange's metalmark butterfly is listed as endangered under the federal Endangered Species Act.

Historical and Current Distribution and Status. Lange's metalmark butterfly is restricted to areas supporting its larval host plant, naked-stemmed buckwheat (Eriogonum nudum), within the Antioch Dunes National Wildlife Refuge in Contra Costa County. The species' historical distribution is unknown.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Lange's metalmark butterfly occurs in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Lange's metalmark butterfly adults are found in close association with its host plant, naked-stemmed buckwheat (Eriogonum nudum). Adults emerge in late summer and live for approximately 1 week. Eggs are deposited on the host buckwheat and remain dormant until it begins to rain, usually in late fall, and the buckwheat begins to grow. Larvae feed on the new growth throughout winter and spring and pupate early in the following summer.

Reasons for Decline. Lange's metalmark butterfly has declined as a result of sand mining at the Antioch Dunes, which has considerably diminished its habitat, and invasive non-native vegetation that outcompetes its host plant.

Designated Critical Habitat. Lange's metalmark butterfly has designated critical habitat at the Antioch Dunes.

Recovery Plan and Recovery Requirements. Lange's metalmark butterfly currently benefits from a recovery plan instituted in March 1980 and revised in April 1984 by USFWS. Plan objectives are to: 1) prevent further loss of the species' habitat at the Antioch Dunes and 2) determine the number of populations necessary for reclassification of the species (U.S. Fish and Wildlife Service 1984).

Citation

U.S. Fish and Wildlife Service. 1984. Recovery plan for three endangered species endemic to Antioch Dunes, California. U. S. Fish and Wildlife Service. Portland, OR.

LONGHORN FAIRY SHRIMP *(Branchinecta longiantenna)*

Legal Status. The longhorn fairy shrimp is listed as endangered under the federal Endangered Species Act.

Historical and Current Distribution and Status. The longhorn fairy shrimp is endemic to California central interior Coast Ranges, Carrizo Plain, and San Joaquin Valley rock outcrop pools and grassland vernal pools and is reported from only 14 locations. The species occurs at elevations between 50 and 2,000 feet. Population distribution is limited within this range to rock outcrop pools in southern Contra Costa County and northern Alameda County, vernal pools in the Kesterson National Wildlife Refuge in Merced County, and on the Carrizo Plain in San Luis Obispo County (Eng et al. 1990).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The longhorn fairy shrimp is found in the West San Joaquin Basin, East San Joaquin Basin, and Suisun Marsh/North San Francisco Bay Ecological Zones.

Life History and Habitat Requirements. The longhorn fairy shrimp occurs in rock outcrop vernal pools and clay- or grassy-bottom vernal pools. Average depth of occupied pools is approximately 2.5 inches. Specimens have been collected from poorly vegetated, turbid pools from November to early April (Eng et al. 1990).

Reasons for Decline. The longhorn fairy shrimp has declined in its range throughout the Central Valley from loss of habitat resulting from agricultural development (Eng et al. 1990).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citation

Eng, L. L., D. Belk, and C. H. Eriksen. 1990. California anostraca: distribution, habitat, and status. Journal of Crustacean Biology 10(2): 247–277.

VALLEY ELDERBERRY LONGHORN BEETLE *(Desmocerus californicus dimorphus)*

Legal Status. The valley elderberry longhorn beetle is listed as threatened under the federal Endangered Species Act.

Historical and Current Distribution. The valley elderberry longhorn beetle is found in scattered populations throughout its historical distribution. The species' range includes most of the California Central Valley north to Trinity County, south to San Diego County, and east to San Bernardino County (Barr 1991).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The valley elderberry longhorn beetle is located in all of the Ecosystem Restoration Program Ecological Zones.

Life History and Habitat Requirements. The adults feed on elderberry (Sambucus mexicanus) foliage and are active from early March through early June. The beetles mate in May and females lay eggs on living elderberry shrubs. Larvae bore through the stems of the shrubs to create an opening in the stem within which they pupate. After metamorphosing into an adult, the beetle chews a circular exit hole through which it emerges (Barr 1991). Current information on the habitat of the beetle indicate that it is found only with its host plant, the elderberry.

Reasons for Decline. The elderberry is common in the riparian forests of the Central Valley. Urban and agricultural development, as well as aggregate mining, have eliminated a high percentage of these forests, reducing and fragmenting the available habitat for the beetle (Barr 1991).

Designated Critical Habitat. Critical habitat for the valley elderberry longhorn beetle has been designated in two areas along the American River in the greater Sacramento metropolitan area (Barr 1991).

Recovery Plan and Recovery Requirements. USFWS has prepared a recovery plan for the valley elderberry longhorn beetle (U.S. Fish and Wildlife Service 1984). The plan does not identify specific management objectives for achieving recovery of the beetle; however, it does identify the following interim objectives: 1) protect three known populations along the American River, the Merced River, and Putah Creek; 2) survey for the presence of populations along selected Central Valley rivers; 3) protect remaining habitat areas within the beetle's suspected historical range; and 4) determine the number of sites and populations necessary to allow delisting of the species.

Citations

Barr, C. B. 1991. The distribution, habitat, and status of the valley elderberry longhorn beetle Desmocerus californicus dimorphus. U.S. Fish and Wildlife Service. Sacramento, CA.

U.S. Fish and Wildlife Service. 1984. Valley elderberry longhorn beetle recovery plan. U. S. Fish and Wildlife Service. Portland, OR.

VERNAL POOL FAIRY SHRIMP *(Branchinecta lynchi)*

Legal Status. The vernal pool fairy shrimp is listed as threatened under the federal Endangered Species Act.

Historical and Current Distribution and Status. The vernal pool fairy shrimp is endemic to small, shallow wetlands in California (Helm 1998). It is found from Shasta County in the north, throughout the Central Valley, and west to the central Coast Ranges. Southern populations occur on the Santa Rosa Plateau and near Rancho, California in Riverside County (Eng et al.1990, Jones & Stokes file information).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The vernal pool fairy shrimp is located in all of the CALFED Ecosystem Restoration Program Ecological Zones except for the Sacramento River and the San Joaquin River Ecological Zones.

Life History and Habitat Requirements. The vernal pool fairy shrimp is found in grassland vernal pools, rock outcrops, and roadside ditches from December through early May (Jones and Stokes file information). The species matures in approximately 26 days, reproduces within 40 days, and lives about 91 days (Helm 1998).

Reasons for Decline. The vernal pool fairy shrimp has declined as a result of agricultural and urban development.

Designated Critical Habitat. Critical habitat for the vernal pool fairy shrimp has not been designated.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

Eng, L. L., D. Belk, and C. H. Eriksen. 1990. California anostraca: distribution, habitat, and status. Journal of Crustacean Biology 10(2): 247–277.

Helm, B. 1998. Biogeography of eight large branchiopods endemic to California. Ecology, Conservation, and Management of Vernal Pool Ecosystems. Proceedings from a 1996 Conference. 19–21 June, 1996, pp 124–139.

VERNAL POOL TADPOLE SHRIMP *(Lepidurus packerdi)*

Legal Status. The vernal pool tadpole shrimp is listed as endangered under the federal Endangered Species Act.

Historical and Current Distribution and Status. The vernal pool tadpole shrimp is found scattered throughout the Central Valley from the Millville and Stillwater Plains in Shasta County south to Merced County (Helm 1998).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. The vernal pool tadpole shrimp is found in all of the CALFED Ecosystem Restoration Program Ecological Zones.

Life History and Habitat Requirements. The vernal pool tadpole shrimp is found in stockponds and vernal pools. The species matures in approximately 38 days, reproduces in 54 days, and lives approximately 144 days. Specimens have been collected from winter through spring (Helm 1998).

Reasons for Decline. The vernal pool tadpole shrimp has declined as a result of agricultural and urban development.

Designated Critical Habitat. The critical habitat has not been designated for the vernal pool tadpole shrimp.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citation

Helm, B. 1998. 1996. Biography of eight large branchiopods endemic to California. Ecology, Conservation, and Management of Vernal Pool Ecosystems. Proceedings from a 1996 Conference. 19–21 June, 1996, pp 124–139.

SONOMA ALOPECURUS *(Alopecurus aequalis* var. *sonomensis)*

Legal Status. Sonoma alopecurus is listed as endangered under the federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Sonoma alopecurus is found in Sonoma and Marin Counties north of the San Francisco Bay Area. Eleven populations of the species have been extirpated and only five remain. Three populations are on private property in Sonoma County, and two are on federally owned land within the Point Reyes National Seashore in Marin County (Natural Diversity Data Base 1998).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Sonoma alopecurus occurs in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Sonoma alopecurus is a tufted, perennial herb of the grass family (Poaceae) that grows 12–30 inches tall (Hickman 1993). The species is found in wet meadows, seasonal wetlands, freshwater marshes, and riparian scrub habitats, and blooms from May through July (Skinner and Pavlik 1994).

Reasons for Decline. Sonoma alopecurus is threatened by habitat loss and trampling by cattle (Skinner and Pavlik 1994).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Natural Diversity Data Base. 1998. California Department of Fish and Game. Natural Heritage Division. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

LARGE-FLOWERED FIDDLENECK *(Amsinckia grandiflora)*

Legal Status. Large-flowered fiddleneck is listed as endangered under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. The large-flowered fiddleneck's historical range was most likely limited to the dry inland hills of Alameda, Contra Costa, and San Joaquin Counties. It is currently known from only three sites: one at a Lawrence Livermore National Laboratory (LLNL) facility southeast of Livermore (comprising two subpopulations: the Droptower and Draney Canyon), another on private property in western San Joaquin County, and a third established from seed at Black Diamond Mines Regional Preserve in Contra Costa County as part of a recovery effort for the species (California Department of Fish and Game 1992).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Large-flowered fiddleneck occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay and West San Joaquin Basin Ecological Zones.

Life History and Habitat Requirements. Large-flowered fiddleneck is an erect, coarsely hairy annual herb of the borage family (Boraginaceae). It grows 30–60 centimeters tall and occurs on hillsides. Historically, the species may have occurred in a variety of grassland habitats. It is found on sandy clay loam soils in valley and foothill grasslands, woodland, and oak savannah communities below an elevation of 1,200 feet. The flowering period is April–May (Skinner and Pavlik 1994).

Reasons for Decline. The decline of large-flowered fiddleneck most likely resulted primarily from competition with non-native annual grasses and forbs, habitat disturbance and herbivory by cattle, urbanization, agricultural conversion, accelerated depletion of seed sources during prolonged droughts, and fire. The population at LLNL has declined precipitously since the 1960s (California Department of Fish and Game 1992).

Designated Critical Habitat. A 160-acre area in western San Joaquin County with steep, west- and south-facing slopes and lightly textured but stable soil located at T3S R4E Section 28 W½ NW ¼ W ½ SW ¼ was designated as critical habitat (50 FR 19376–19378, May 8, 1985).

Recovery Plan and Recovery Requirements. The U.S. Fish and Wildlife Service (USFWS) prepared a recovery plan that recommends enhancing the LLNL population and establishing at least four other populations from seed within the species' historical range (U.S. Fish and Wildlife Service 1997).

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Skinner, M. W. and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. Publication No. 1. 5th edition. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service. 1997. Large-flowered fiddleneck (Amsinckia grandiflora) recovery plan. Portland, OR.

IONE MANZANITA *(Arctostaphylos myrtifolia)*

Legal Status. Ione manzanita is federally listed as threatened under the federal Endangered Species Act. It is listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Ione manzanita is endemic to Amador and Calaveras Counties (Natural Diversity Data Base 1998). Historically, its distribution has Most likely always been limited to soils of the Ione Formation in the Sierra Nevada foothills (Hickman 1993, Skinner and Pavlik 1994).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Ione manzanita occurs or has the potential to occur in the Eastside Delta Tributaries Ecological Zone.

Life History and Habitat Requirements. Ione manzanita is an evergreen, perennial shrub of the heath family (Ericaceae) that grows to 1 meter tall (Hickman 1993). The species occurs on acidic Ione clay or sandy soils in chaparral and woodland habitats (Skinner and Pavlik 1994). Although fire destroys mature plants, it stimulates seed germination. Ione manzanita blooms from November through February (Skinner and Pavlik 1994).

Reasons for Decline. Strip mining for clay and sand in the Ione and Carbondale areas has substantially decreased the size of populations in these areas. Further declines are attributed to increased urbanization and the clearing of vegetation for agriculture, fire protection, and off-road-vehicle recreation. Ione manzanita is also threatened by fungal infection and continued mining practices (Skinner and Pavlik 1994).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Natural Diversity Data Base. 1998. California Department of Fish and Game. Natural Heritage Division. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

PALLID MANZANITA *(Arctostaphylos pallida)*

Legal Status. Pallid manzanita, also known as Alameda manzanita, is state listed as endangered and federally listed as threatened under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Pallid manzanita is known from approximately 13 populations in Alameda and Contra Costa Counties. The three largest populations, which are on property owned by the East Bay Regional Park District, are located at Huckleberry and Sobrante Ridges. Several other small, natural and planted populations of pallid manzanita occur in Alameda and Contra Costa Counties (California Department of Fish and Game 1999). The overall trend for the species is stable (California Department of Fish and Game 1999)

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Pallid manzanita occurs in the Suisun Marsh/North San Francisco Bay Ecological Zone

Life History and Habitat Requirements. Pallid manzanita is an upright, non-burl-forming shrub in the heath family (Ericaceae). The species grows from 2 to 4 meters (m) (6.5 to 13.0 feet [ft]) tall and has rough gray or reddish bark. Pallid manzanita is found at elevations from 200 to 445 m (656 to 1460 ft), primarily on thin soils composed of chert and shale (Amme and Havlik 1987). Known populations are found on slopes and ridges of maritime chaparral and coastal scrub communities, requiring mesic soil conditions and maritime influence. Flowering period is from December to March (Skinner and Pavlik 1994).

Reasons for Decline. Urbanization, alteration of fire regimes, competition from non-native plants, and fungal infection threaten the pallid manzanita (Skinner and Pavlik, 1994). The habitat of pallid manzanita has been lost primarily to residential development and most populations are so isolated and small that their long-term viability is questionable (California Department of Fish and Game 1999).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

Amme, D. and N. Havlik. 1987. An ecological assessment of Arctostaphylos pallida Eastw., Alameda and Contra Costa Counties. Four Seasons 7(4):28–46.

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

CLARA HUNT'S MILKVETCH *(Astragalus clarianus)*

Legal Status. Clara Hunt's milkvetch is state listed as threatened and federally listed as endangered under the California and federal Endangered Species Acts. It is listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Clara Hunt's milkvetch occurs in five small populations in Napa and Sonoma Counties. Numbers of individuals within populations have been very low. The overall trend for Clara Hunt's milkvetch is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Clara Hunt's milkvetch occurs in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Clara Hunt's milkvetch is a slender annual of the legume family (Fabaceae) that grows from 3 to 12 centimeters tall (Hickman 1993). The species occurs on rocky, thin, clay soils in sparsely vegetated openings within blue-oak woodland and grassland communities. Clara Hunt's milkvetch blooms in March and April (Skinner and Pavlik 1994).

Reasons for Decline. The main reasons for decline are habitat modification and destruction as a result of development. Because Clara Hunt's milkvetch exists in extremely small populations, the species could be eliminated through random fluctuations in population size from year to year or other chance events such as drought or invasion by weeds (California Department of Fish and Game 1999).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

_____. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

SONOMA SUNSHINE *(Blennosperma bakeri)*

Legal Status. Sonoma sunshine, also known as Baker's stickyseed, is listed as endangered under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Sonoma sunshine is restricted to the Santa Rosa Plains and the adjacent Sonoma Valley of Sonoma County, California. It is known from 35 sites in Cotati Valley and seven other sites in Sonoma Valley. From north to south in Cotati Valley, the species ranges from near the city of Fulton to Scenic Avenue, which is between the cities of Santa Rosa and Cotati. In the Sonoma Valley, the species extends or extended from near Glen Ellen to near the junction of State Routes 116 and 121. The overall trend for this species is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Sonoma sunshine occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Sonoma sunshine is a small, annual herb of the sunflower family (Asteraceae) that has alternate, narrow, hairless leaves and grows 12 inches tall. Sonoma sunshine is found in shallow depressions, intermittent swales, and mesic grasslands. From March through April, the plant produces yellow, daisy-like flowers (California Department of Fish and Game 1999).

Reasons for Decline. At least 30% of the historical occurrences of Sonoma sunshine have been eliminated or seriously damaged. Most of the remaining sites are threatened by urbanization, wastewater effluent irrigation, and agricultural land conversion. Westward expansion of the city of Santa Rosa threatens at least half the remaining habitat.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. Protection measures for this species are expected to be included in U.S. Fish and Wildlife Service's (USFWS's) Draft California Vernal Pool Ecosystem Recovery Plan, to be released for public review in 1999 (California Department of Fish and Game 1999).

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

CHINESE CAMP BRODIAEA *(Brodiaea pallida)*

Legal Status. Chinese Camp brodiaea is state listed as endangered and federally listed as threatened under the California and federal Endangered Species Acts. It is listed as Category 1B by the California Native Plant Society (CNPS).

Historical and Current Distribution and Status. Chinese Camp brodiaea is a perennial herb known from only one location southwest of Chinese Camp in Tuolumne County. The population is restricted to a narrow 10- to 20-foot-wide area along a 0.5-mile-long section of an intermittent stream entirely on private property (California Department of Fish and Game 1999). Because of its specific habitat requirements, the historical distribution of Chinese Camp brodiaea was probably not much more extensive than the current distribution. Currently, Chinese Camp brodiaea is stable (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Chinese Camp brodiaea occurs or has the potential to occur in the East San Joaquin Basin Ecological Zone.

Life History and Habitat Requirements. Chinese Camp brodiaea is an herbaceous perennial in the lily family (Liliaceae). The species grows along a shallow, intermittent stream in clay derived from serpentine (California Department of Fish and Game 1999). The pink flowers of the Chinese Camp brodiaea bloom from May through June (Skinner and Pavlik 1994).

Reasons for Decline. Species such as Chinese Camp brodiaea that have very small populations and occupy only a small area are vulnerable to decline and extinction from genetic problems and random catastrophic events such as floods, attack by insects, disease, or extended droughts (California Department of Fish and Game 1999). Cattle grazing and alteration of the existing hydrological conditions are possible reasons for decline (California Department of Fish and Game 1998). Chinese Camp brodiaea is also threatened by residential development (Skinner and Pavlik 1994).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

TIBURON MARIPOSA LILY *(Calochortus tiburonensis)*

Legal Status. Tiburon mariposa lily is listed as threatened under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Tiburon mariposa lily was discovered in 1971 by R. West on Ring Mountain on the Tiburon Peninsula in Marin County, California. Its distribution comprises roughly three populations, all of which occur in the Ring Mountain Preserve. Ownership and management of this preserve was recently transferred from The Nature Conservancy to the Marin County Department of Parks, Open Space, and Cultural Services (California Department of Fish and Game 1999). The overall trend for Tiburon mariposa lily is stable (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Tiburon mariposa lily occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Tiburon mariposa lily is a bulbous perennial of the lily family (Liliaceae) with a single, persistent, basal, linear-oblong leaf 1–2 feet long. The species is known only from a serpentine grassland on the north slope of Ring Mountain (California Department of Fish and Game 1999). Tiburon mariposa lily blooms from March through June (Skinner and Pavlik 1994).

Reasons for Decline. Tiburon mariposa lily has been identified as stable (California Department of Fish and Game 1999).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A draft recovery plan has been prepared for this species by the U.S. Fish and Wildlife Service (USFWS) (1998). Recovery strategy elements include protecting existing subpopulations and buffer areas for expansion and securing any newly discovered populations. It is recommended that management plans include standardized monitoring every 3 years, developing strategies to minimize known threats, and an educational outreach program. Seedbanks are also recommended (U.S. Fish and Wildlife Service 1998).

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service. 1998. Draft recovery plan for serpentine soil species of the San Francisco Bay Area. U.S. Fish and Wildlife Service. Portland, OR.

STEBBINS' MORNING-GLORY *(Calystegia stebbinsii)*

Legal Status. Stebbins' morning-glory is listed as endangered under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Stebbins' morning-glory is endemic to the northern Sierra Nevada foothills. The species appears to have always been uncommon and limited in distribution. Stebbins' morning-glory is known from only 16 occurrences (Natural Diversity Data Base 1998), two of which are on public land (California Department of Fish and Game 1999). Stebbins' morning-glory occurs in the Pine Hill gabbro formation of the Sierra Nevada foothills of El Dorado County and on serpentine near Grass Valley in Nevada County. The Pine Hill formation comprises approximately 30,000 acres, approximately one-half of which contain the habitat types that support this rare species. In the southern half of the Pine Hill gabbro formation, residential areas have been recently developed in unsurveyed habitat near known colonies of the morning-glory. Potential habitat near known colonies has also been cleared under ministerial grading permits (California Department of Fish and Game 1999). The overall trend for Stebbins' morning-glory is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Stebbins' morning-glory occurs or has the potential to occur in the Eastside Delta Tributaries Ecological Zone.

Life History and Habitat Requirements. Stebbins' morning glory is a perennial of the morning glory family (Convolvulaceae). This herbaceous vine grows on red clay or serpentine soils in openings in chaparral and blue oak-foothill pine communities (California Department of Fish and Game 1999, Skinner and Pavlik 1994). The large, funnel-shaped, white flowers of the Stebbins' morning-glory bloom from May through June (Skinner and Pavlik 1994).

Reasons for Decline. Habitat for Stebbins' morning-glory has been reduced by residential and commercial development; several of the known occurrences have been extirpated (Natural Diversity Data Base 1998). The species is also threatened by off-road-vehicle use and road maintenance (Skinner and Pavlik 1994).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A draft recovery plan for the species has been prepared by the U.S. Fish and Wildlife Service (USFWS) (64 FR 11035-11036, March 8, 1999).

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Natural Diversity Data Base. 1998. California Department of Fish and Game. Natural Heritage Division. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

SAN BENITO EVENING PRIMROSE *(Camissonia benitensis)*

Legal Status. San Benito evening primrose is listed as threatened under the federal Endangered Species Act and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. The distribution of San Benito evening primrose is from the inner southern Coast Range of California, specifically the lower Clear Creek drainage area of San Benito County (Hickman 1993); however, it is only known from the New Idria area (Skinner and Pavlik 1994).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. San Benito evening primrose occurs or has the potential to occur in the West San Joaquin Basin Ecological Zone.

Life History and Habitat Requirements. San Benito evening primrose is an annual herb of the evening primrose family (Onagraceae) (Hickman 1993). The species grows in an erect to decumbent manner, 3–20 centimeters tall (Hickman 1993). San Benito evening primrose occurs on terraces of chaparral and cismontaine woodlands in clay or gravelly serpentine alluvial soils (Hickman 1993) and has a blooming period from May through June (Skinner and Pavlik 1994).

Reasons for Decline. San Benito evening primrose is threatened by the use of off-road vehicles near existing populations.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A draft recovery plan for the species has been prepared by USFWS (64 FR 5066-5067, February 2, 1999).

Citations

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

WHITE SEDGE *(Carex albida)*

Legal Status. White sedge is listed as endangered under the California and federal Endangered Species Acts and is listed as category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. White sedge was thought to be extinct until 1987, when a single population was found in lower Pitkin Marsh in Sonoma County, California. This single extant population has approximately 800 to 1,000 plants. White sedge has been extirpated from its four historical populations at Santa Rosa Creek, Perry Marsh, and Upper and Middle Pitkin Marsh. The overall trend for white sedge is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. White sedge occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay Ecological Management Zone.

Life History and Habitat Requirements. White sedge is a short, loosely tufted, grass-like perennial herb of the sedge family (Cyperaceae). This species has erect stems that sprout from a creeping rhizome, flattened leaves, and flowers in dense terminal spikes. This species is found in bogs, fens, and moist sites adjacent to freshwater marshes and creeks. Blooming period: May–July (Skinner and Pavlik 1994).

Reasons for Decline. Habitat conversion, wetland drainage, chemical effluent, and cattle grazing have eliminated several historical white sedge occurrences. The site on which the only extant population occurs is subject to persistent development pressures (California Department of Fish and Game 1999). Current populations of white sedge are threatened by drought, development pressures, and competition from other plants (Skinner and Pavlik 1994). Because white sedge exists in only one confirmed location, it is susceptible to random or chance events.

Designated Critical Habitat. None.

Conservation Efforts. This section is to be prepared by CALFED, the U.S. Fish and Wildlife Service (USFWS), and the California Department of Fish and Game (DFG).

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared, and recovery requirements have not been identified for this species.

Research or Monitoring Gaps. This section is to be prepared by CALFED, USFWS, and DFG.

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

TIBURON INDIAN PAINTBRUSH *(Castilleja affinis* ssp. *neglecta)*

Legal Status. Tiburon Indian paintbrush is state listed as threatened and federally listed as endangered under the California and federal Endangered Species Acts. It is listed as category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Tiburon Indian paintbrush occurs on serpentine soils in Marin and Napa Counties. Its historical distribution may have been limited to serpentine soils in the north bay area. There are seven known existing occurrences of the plant. Three occur on the Tiburon Peninsula in Marin County, with a total of approximately 250 plants in 1997. A portion of one of these three populations was recently destroyed by a residential development, and a portion of the plants formerly seen at a second population has not been observed in recent years. Approximately 550 plants occur at a private quarry in American Canyon in Napa County. Two sites, with a total of approximately 75 plants, occur on Golden Gate National Recreation Area lands in Marin County. One location on private land in Santa Clara County supported approximately 30 plants in 1996 (California Department of Fish and Game 1999). The overall trend for Tiburon Indian paintbrush is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Tiburon Indian paintbrush occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay Ecological Management Zone.

Life History and Habitat Requirements. Tiburon Indian paintbrush is a semi-woody hemiparasitic perennial of the figwort family (Scrophulariaceae) that grows 15-60 centimeters tall (Hickman 1993). This species occurs on north-to-west facing slopes in serpentine bunchgrass communities. The showy, yellow to red-yellow flowers of the Tiburon Indian paintbrush bloom from April through June (Skinner and Pavlik 1994).

Reasons for Decline. Tiburon Indian paintbrush populations are threatened by residential development, foot traffic, grazing, soil slumping, and gravel mining (Federal Register 60:6684; February 3, 1995).

Designated Critical Habitat. None.

Conservation Efforts. Tiburon Indian paintbrush is protected in part at Ring Mountain Preserve, which is managed by The Nature Conservancy (Skinner and Pavlik 1994). In 1997, the California Department of Fish and Game (DFG) held two recovery workshops to address Tiburon Indian paintbrush and 11 other plants known from serpentine habitats in the San Francisco Bay Area. Several participants volunteered to remove pampas grass and broom plants that are threatening the Tiburon Peninsula populations and to monitor the plants in 1998. Priority recovery actions identified by workshop participants included research into the management needs of the plant and protecting the populations on private lands (California Department of Fish and Game 1999).

Recovery Plan and Recovery Requirements. A draft recovery plan has been prepared for this species by the U.S. Fish and Wildlife Service (USFWS) (1998). Recovery strategy elements include protection of existing populations and buffer areas for expansion and securing unpopulated habitat. It is recommended that management plans include standardized monitoring every other year, development of strategies to minimize known threats, removal of non-native plants, and an educational outreach program. Additionally, seed banking and surveys of potential habitat for new populations and potential introduction sites are recommended (U.S. Fish and Wildlife Service 1998).

Research or Monitoring Gaps. This section is to be prepared by CALFED, the USFWS, and DFG.

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service. 1998. Draft recovery plan for serpentine soil species of the San Francisco Bay Area. U.S. Fish and Wildlife Service, Portland, Oregon.

SUCCULENT OWL'S-CLOVER *(Castilleja campestris* var. *succulentus)*

Legal Status. Succulent owl's-clover is state listed as endangered and federally listed as threatened under the California and federal Endangered Species Acts. It is listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Succulent owl's-clover is endemic to the eastern edge of the central San Joaquin Valley, from Stanislaus County to Fresno County (California Department of Fish and Game 1992). Historically, the species was more widespread in the Central Valley (62 CFR 14338).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Succulent owl's-clover occurs and has the potential to occur in the Eastside Delta Tributaries and East San Joaquin Basin Ecological Zones.

Life History and Habitat Requirements. Succulent owl's-clover is an annual herb in the figwort family (Scrophulariaceae) that grows 5–25 centimeters tall and occurs in drying vernal pools in valley grassland or woodland habitats (California Department of Fish and Game 1992, Natural Diversity Data Base 1998).

Reasons for Decline. Agricultural conversion, disking of pools, competition from introduced weeds, overgrazing, and urbanization in the San Joaquin Valley have eliminated vernal pool habitat and continue to threaten this species (California Department of Fish and Game 1992).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Natural Diversity Data Base. 1998. Database search of Castilleja campestris var. succulentus. California Department of Fish and Game. Sacramento, CA.

PINE HILL CEANOTHUS *(Ceanothus roderickii)*

Legal Status. Pine Hill ceanothus is state listed as rare under the California Native Plant Protection Act and federally listed as endangered under the federal Endangered Species Act. It is listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Pine Hill ceanothus is endemic to the Pine Hill geologic formation in the Sierra Nevada foothills of El Dorado County. The historical range of the ceanothus was probably limited to its current range, although populations were most likely larger and more continuous than they are now (California Department of Fish and Game 1992) (59 FR [76]:18774–18783, April 20, 1994). There are approximately 15 occurrences of Pine Hill ceanothus. Four occurrences are protected, two in the vicinity of Salmon Falls, one on Pine Hill, and another in the vicinity of Cameron Park. The overall trend for species is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Pine Hill ceanothus occurs or has potential to occur in the American River Basin and Eastside Delta Tributaries Ecological Zones.

Life History and Habitat Requirements. Pine Hill ceanothus is a prostrate evergreen woody shrub in the buckthorn family, (Rhamnaceae) that generally grows to 98.0 inches in diameter (59 FR [76]:18774–18783, April 20, 1994). Pine Hill ceanothus is endemic to the red clay soils of the Pine Hill gabbro formation within openings in chaparral and oak woodland, or more infrequently on previously disturbed sites within chaparral. From May to June, the shrubs bear small whitish flowers that are tinged with blue (Skinner and Pavlik 1994).

Reasons for Decline. Residential and commercial development, inadequate regulatory mechanisms, off-road-vehicle use, road widening, changes in fire frequency, and other human-caused conditions are the known reasons for the species decline. Two known occurrences have been extirpated by commercial development (59 FR [76]:18774–18783, April 20, 1994).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A draft recovery plan for the species has been prepared by the U.S. Fish and Wildlife Service (USFWS) (64 FR 11035–11036, March 8, 1999).

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

_____. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

HOOVER'S SPURGE *(Chamaesyce hooveri)*

Legal Status. Hoover's spurge is listed as threatened under the federal Endangered Species Act and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Hoover's spurge is endemic to vernal pool complexes in the eastern Central Valley. Its historical distribution is not well documented, but it is presumed that it was more common than at present among the vernal pools of the eastern Sacramento and San Joaquin Valleys. Approximately 15 extant populations occur in three clusters: one in Tehama, Butte, and Glenn Counties; another in eastern Stanislaus County; and another in northwestern Tulare County (Natural Diversity Data Base 1998). All of these populations are on privately owned lands (58 FR [149]:41700–41708, August 5, 1993).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Hoover's spurge occurs or has the potential to occur in the Butte Basin, Colusa Basin, East San Joaquin Basin, and Sacramento River Ecological Zones.

Life History and Habitat Requirements. Hoover's spurge is a small, prostrate, annual herb of the spurge family (Euphorbiaceae) that forms mats from a few inches to a few feet across (FR [149]:41700–41708, August 5, 1993). Hoover's spurge occurs in relatively large, deep vernal pools among the rolling hills, remnant alluvial fans, and depositional stream terraces at the base of the Sierra Nevada foothills. It tends to occur where competition from other species has been reduced by prolonged inundation or other factors. Hoover's spurge blooms in July (Skinner and Pavlik 1994).

Reasons for Decline. Loss of vernal pool habitat to irrigated agriculture has most likely caused most of the decline in this species. Continued expansion of agricultural development threatens about one-third of the remaining populations. Moderate livestock grazing appears to not threaten the plant, although intensive grazing and trampling of vernal pools could have adverse effects on the species (58 FR [149]:41700–41708, August 5, 1993).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

Natural Diversity Data Base. 1998. California Department of Fish and Game. Natural Heritage Division. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

SONOMA SPINEFLOWER *(Chorizanthe valida)*

Legal Status. Sonoma spineflower is listed as endangered under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society (CNPS).

Historical and Current Distribution and Status. Until its rediscovery in 1980, Sonoma spineflower was thought to be extinct. The worldwide distribution of Sonoma spineflower is limited to one site in Marin County, just south of Abbott's Lagoon, on a working cattle ranch within Point Reyes National Seashore. This species occupies less than 2.5 acres of land within an enclosed pasture of about 360 acres. A census conducted by CNPS volunteers in 1996 revealed 75% fewer plants than in 1992, when the population numbers were at their highest (California Department of Fish and Game 1999). The overall trend for Sonoma spineflower is stable to declining (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Sonoma spineflower occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Sonoma spineflower is a robust annual herb in the buckwheat family (Polygonaceae) that grows 10–30 centimeters tall. The species is known to occur only in sandy soils of coastal grassland prairie habitats (Hickman 1993, Skinner and Pavlik 1994). The pinkish flowers of the Sonoma spineflower bloom from June through August (Skinner and Pavlik 1994).

Reasons for Decline. Sonoma spineflower is threatened by cattle grazing (Hickman 1993).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

SUISUN THISTLE *(Cirsium hydrophilum* var. *hydrophilum)*

Legal Status. Suisun thistle is listed as endangered under the federal Endangered Species Act and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Suisun thistle is known from four locations, three of which are on California Department of Fish and Game (DFG) land in Suisun Marsh and one on Solano County Farmland and Open Space Foundation land (Natural Diversity Data Base 1998). It is likely that this species was more widespread in the past because its saltmarsh was more widespread. This habitat has been extremely reduced during this century (Macdonald 1977).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Suisun thistle occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Suisun thistle is a perennial herb in the sunflower family (Asteraceae) and reaches a height of 3–4.5 feet. It occurs on the edges of salt- and brackish marshes that are periodically inundated during high tides. It is restricted to a narrow tidal band, typically in higher elevation zones within larger tidal marshes that have fully developed tidal channel networks. The species usually does not occur in smaller fringe tidal marshes that are less than 300 feet wide or in nontidal areas. Flowering time is July–September.

Reason for Decline. Drainage or filling of saltmarshes, and possibly water pollution, may have contributed to the decline of Suisun thistle (Niehaus 1977). Its restricted distribution increases its susceptibility to catastrophic events such as disease or pest outbreak, severe drought, oil spills, or other natural or human-induced disasters. Continued habitat conversion, habitat fragmentation, indirect effects from urban development, increased salinity, alteration of natural tidal regime, mosquito abatement activities, and competition with non-native plants also threaten Suisun thistle (60 CFR 112).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

Macdonald, K. B. 1977. Coastal salt marsh. Pages 263–294 in Barbour, M. G. and J. Major (eds.), Terrestrial vegetation of California. Wiley. New York, NY.

Natural Diversity Data Base. 1998. Database search for Cirsium hydrophilum var. hydrophilum. California. Department of Fish and Game. Sacramento, CA.

Niehaus, T. 1977. Rare plants species report for Suisun thistle. California Native Plant Society. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

SOFT BIRD'S-BEAK *(Cordylanthus mollis* ssp. *mollis)*

Legal Status. Soft bird's-beak is listed as endangered under the federal Endangered Species Act, as rare under the California Native Plant Protection Act, and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Soft bird's-beak is an annual herb endemic to the northern shores of the San Francisco Bay, Suisun Marsh, and the saltmarshes south of Suisun Bay, at elevations below 30 feet. Twelve historical occurrences were known from Marin to Contra Costa Counties, where the counties border San Francisco Bay (Natural Diversity Data Base 1998). In 1991, the species was known to be extant at only three sites: Benicia State Recreation Area, California Department of Fish and Game (DFG) land along the Napa River at Fagan Slough, and Point Pinole Regional Shoreline (California Department of Fish and Game 1992).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Soft bird's-beak occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay and Yolo Basin Ecological Zones.

Life History and Habitat Requirements. Soft bird's-beak is a semiparasitic herbaceous annual plant in the figwort family (Scrophulariaceae). It grows 25–40 centimeters tall and occurs in coastal saltmarshes and brackish marshes. The species is restricted to a narrow tidal band, typically in higher elevation zones within larger tidal marshes that have fully developed tidal channel networks. It usually does not occur in smaller fringe tidal marshes that are generally less than 300 feet wide or in nontidal areas. Flowering time is July–September.

Reasons for Decline. Habitat conversion, water pollution, changes in salinity, indirect effects of urbanization, mosquito abatement activities, off-road-vehicle use, competition with non-native vegetation, insect predation, erosion, and other human-induced actions have contributed to the decline of soft bird's-beak. The sensitivity of the species to changes in environmental conditions is evidenced by the extreme fluctuations in annual population size. (California Department of Fish and Game 1992.)

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state listed threatened and endangered animals and plants. Sacramento, CA.

Natural Diversity Data Base. 1998. Database search for Cordylanthus mollis ssp. mollis. California. Department of Fish and Game. Sacramento, CA.

PALMATE-BRACTED BIRD'S-BEAK *(Cordylanthus palmatus)*

Legal Status. Palmate-bracted bird's-beak, also known as Ferris' bird's-beak, is listed as endangered under California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. The palmate-bracted bird's-beak's original range was probably similar to its current range, but populations were more numerous and contained more individuals. Today, the species occurs at Delevan National Wildlife Refuge, at Colusa National Wildlife Refuge, near the city of Woodland, in the Springtown alkali sink north of Livermore, at the California Department of Fish and Game's (DFG's) Alkali Sink Ecological Reserve in Fresno County, in western Madera County, and at Sacramento National Wildlife Refuge in Glenn County (California Department of Fish and Game 1992).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Palmate-bracted bird's-beak occurs or has the potential to occur in the Eastside Delta Tributaries, East San Joaquin Basin, San Joaquin River, West San Joaquin Basin, Colusa Basin, Feather River/Sutter Basin, Sacramento River, and Yolo Basin Ecological Zones.

Life History and Habitat Requirements. Palmate-bracted bird's-beak is an annual herb of the figwort family (Scrophulariaceae) that grows 10–30 centimeters tall. It is endemic to moist lowlands in the Central and Livermore Valleys and is restricted to saline-alkaline soils in relatively undisturbed, seasonally flooded, alkali-sink scrub habitats at elevations below 500 feet. Flowering time is May–October.

Reasons for Decline. Habitat for the species has been eliminated and degraded by its conversion to agricultural and urban development, draining of seasonal wetlands, grazing, off-road-vehicle use, and trash dumping (California Department of Fish and Game1992).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. The U.S. Fish and Wildlife Service (USFWS) is in the process of identifying recovery requirements and preparing a recovery plan for this species.

Citation

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

BAKER'S LARKSPUR *(Delphinium bakeri)*

Legal Status. Baker's larkspur is state listed as rare under the California Native Plant Protection Act and federally listed as endangered under the federal Endangered Species Act. It is listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Baker's larkspur was once known from several populations in Marin and Sonoma Counties. The single remaining population is on a grassy bank on privately owned land along the edge of Marshall-Petaluma Road in northwestern Marin County and is extremely small (24 plants observed in 1988) (California Department of Fish and Game 1992, Natural Diversity Data Base 1998). The population size appears to be relatively stable (California Department of Fish and Game 1998); however, this species is exceptionally vulnerable to chance catastrophic events. Although Baker's larkspur has always been rare, habitat losses have nearly caused its extinction. This species is considered to be in decline.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Baker's larkspur occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Baker's larkspur, a member of the buttercup family (Ranunculaceae), is an erect, leafy-stemmed herbaceous perennial with showy blue-and-white flowers that grows 45–100 centimeters tall. It occurs in coastal scrub habitat at an elevation of between 300 and 1,000 feet. Flowering time is March–May. (Hickman 1993, Skinner and Pavlik 1994.)

Reasons for Decline. Baker's larkspur has become endangered from extensive grazing, roadside maintenance activities, and conversion of its habitat to cultivated farmland. It continues to be threatened by road maintenance activities and collecting.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

_____. 1998. Annual report on the status of California's state-listed threatened and endangered animals and plants. Sacramento, CA.

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Natural Diversity Data Base. 1998. California Department of Fish and Game. Natural Heritage Division. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

YELLOW LARKSPUR *(Delphinium luteum)*

Legal Status. Yellow larkspur, also known as golden larkspur, is state listed as rare under the California Native Plant Protection Act, federally listed as endangered under the federal Endangered Species Act, and listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. The restricted distribution of yellow larkspur is centered near the town of Bodega Bay in Sonoma County, with fewer than a dozen historical occurrences recorded (California Department of Fish and Game 1999). It is currently known from two populations, both on private land. The accessible population had 130 plants in 1985, but a count in 1997 revealed only 83. The general status of the yellow larkspur is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Yellow larkspur occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Yellow larkspur is a herbaceous perennial of the buttercup family (Ranunculaceae) that grows 20–55 centimeters tall on steep, rocky outcrops within coastal sage scrub, coastal grassland, or chaparral plant communities (California Department of Fish and Game 1999, Hickman 1993). Flowering period is March–May (Skinner and Pavlik 1994).

Reasons for Decline. Rock quarrying activities, overcollecting, hybridization, residential development, and sheep grazing have reduced the populations such that today, there are only two known remaining populations of genetically pure yellow larkspur (California Department of Fish and Game 1999).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

HOOVER'S ERIASTRUM *(Eriastrum hooveri)*

Legal Status. Hoover's eriastrum, also known as Hoover's woolly-star, is listed as threatened under the federal Endangered Species Act and as Category 4 by the California Native Plant Society.

Historical and Current Distribution and Status. Hoover's eriastrum is an annual herb endemic to the Temblor Range (Kern and San Luis Obispo Counties), Cuyama Valley (San Luis Obispo and Santa Barbara Counties), and discontinuously in the San Joaquin Valley from Fresno County south, excluding the vicinity of Tulare Lake. Hoover's eriastrum is known from approximately 40 extant populations (Natural Diversity Data Base 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Hoover's eriastrum occurs in the West San Joaquin Basin Ecological Zone.

Life History and Habitat Requirements. Hoover's eriastrum is a small annual herb in the phlox family (Polemoniaceae). The species grows 2–3 inches tall and has grayish, fuzzy stems, slender branches, and small white flowers about 0.25 inch wide. Hoover's eriastrum grows in scrub-grassland habitats with moderate cover of saltbush. It often grows in cryptogamic soil crusts (i.e., mats of moss, lichen, and algae) that reduce competition from annual grasses (U.S. Fish and Wildlife Service 1998). The species blooms from April through July (Skinner and Pavlik 1994).

Reasons for Decline. Hoover's eriastrum has declined mainly as a result of habitat conversion to agricultural and urban uses. Most of the known extant populations are threatened by future conversions to agricultural use, groundwater recharge basins, and oil and gas development. Although some sites contain substantial populations (5,000–40,000 individuals), most of the remaining sites on the Valley floor are at risk because they are isolated from one another, range from approximately 1 acre to less than 400 acres, and contain fewer than 1,000 individuals (55 FR [139]:29361–29370, July 19, 1990).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. The U.S. Fish and Wildlife Service (USFWS) has prepared a recovery plan for upland species of the San Joaquin Valley, which includes Hoover's eriastrum and other species. Recovery strategy for Hoover's eriastrum includes monitoring a minimum acreage and density of the species to determine trends within metapopulations and to reassess management strategies if density declines (U.S. Fish and Wildlife Service 1998).

Citations

Natural Diversity Data Base. 1999. California Department of Fish and Game. Natural Heritage Division. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service. 1998. Recovery plan for upland species of the San Joaquin Valley, California. Portland, OR.

IONE BUCKWHEAT *(Eriogonum apricum* var. *apricum)*

Legal Status. Ione buckwheat is state listed as endangered and federally listed as endangered under the California and federal Endangered Species Acts. It is listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Ione buckwheat is endemic to the Ione region of Amador County (California Department of Fish and Game 1992) in the northern Sierra Nevada foothills (Hickman 1993). These plants have most likely always had limited distribution because they occur only on unusual soils of the Ione Formation. Only 10 extant occurrences of Ione buckwheat exist (Skinner and Pavlik 1994). The overall trend for Ione buckwheat is unknown (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Ione buckwheat occurs or has the potential to occur in the Eastside Delta Tributaries Ecological Zone.

Life History and Habitat Requirements. Ione buckwheat is a compact, erect, herbaceous perennial in the buckwheat family (Polygonaceae) with felt-like lower leaves on short stems and white flowers with reddish midribs. Ione buckwheat occurs strictly in Ione chaparral. The species has adapted to the unique, gravelly kaolinitic clay soils that characterize this community. Flowering period is July–October (Skinner and Pavlik 1994).

Reasons for Decline. The buckwheats, always limited by the distribution of their habitat, most likely experienced severe reductions in the early part of this century during a period of extensive clay mining. Further declines are attributed to increasing urbanization and the clearing of vegetation for agriculture and fire protection. Active clay mining continues to reduce potential habitat suitable for these species. Ione buckwheat is threatened by off-road-vehicle use, increasing urbanization, clay mining, erosion, and conversion of habitat to agriculture or fire protection (California Department of Fish and Game 1999, Skinner and Pavlik 1994).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

_____. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

LOCH LOMOND BUTTON-CELERY *(Eryngium constancei)*

Legal Status. Loch Lomond button-celery, also known as Loch Lomond coyote-thistle, is listed as endangered under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Loch Lomond button-celery was first collected by Robert Hoover in 1941. In 1973, the species was found in the vernal lake near the community of Loch Lomond in southern Lake County, California at an elevation of between 2,800 and 3,000 feet. Other vernal lakes in the general area may also harbor small isolated stands of the Loch Lomond button-celery. Surveys done in 1978 and 1984 failed to discover Loch Lomond button-celery populations in other locations.

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Loch Lomond button-celery occurs in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Loch Lomond button-celery, a perennial herb of the carrot family (Apiaceae), annually produces slender, weak scapes (leafless, flowering stalks) up to 30 centimeters tall from its overwintering rootstock (Sheikh 1978, 1983). Loch Lomond button-celery grows abundantly within the borders of the meadow-like bed of the Loch Lomond lake. The soil of the lake bed consists of a volcanic silty clay. Loch Lomond button-celery blooms from April through June (Skinner and Pavlik 1994).

Reasons for Decline. Habitat degradation is the main threat to populations of the Loch Lomond button-celery.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

Sheikh, M. Y. 1978. A systematic study of west North American Eryngium (Umbelliferae-Apiaceae). Ph.D. dissertation, University of California, Berkeley. Berkeley, CA.

Sheikh, M. Y. 1983. New taxa of western North American Eryngium (Umbelliferae). Madrono 30:93-101.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

CONTRA COSTA WALLFLOWER *(Erysimum capitatum* ssp. *angustatum)*

Legal Status. Contra Costa wallflower is listed as endangered under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Contra Costa wallflower is endemic to Antioch Dunes in northern Contra Costa County, near the confluence of the Sacramento and San Joaquin Rivers, at an elevation of from 50 to 80 feet. Its historical range may not have been much greater than its current range, a 70-acre area of sandy bluffs overlooking the San Joaquin River (Natural Diversity Data Base 1998).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Contra Costa wallflower occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay and Yolo Basin Ecological Zones.

Life History and Habitat Requirements. Contra Costa wallflower, a member of the mustard family (Brassicaceae), is a coarse-stemmed, erect, herbaceous biennial, 20–80 centimeters tall. It grows in fine sand with some clay among grasses, shrubs, and other forbs on and near the tops of remnants of ecologically stabilized interior dunes. Flowering time is March–July.

Reasons for Decline. Interior dune habitat found in the Sacramento-San Joaquin Delta has been reduced to a fragment of its original extent by industrial development and sand mining. The remaining habitat has been disturbed and degraded by rototilling for fire control, off-road-vehicle activity, and the establishment of and competition by aggressive non-native plants (California Department of Fish and Game 1992).

Designated Critical Habitat. Inland dune habitat near Antioch at T2N, R2E, Section 17 SW ¼, and Section 18 E ⅔ of S ½ was designated as critical habitat (42 FR no.26, February 8, 1977).

Recovery Plan and Recovery Requirements. USFWS has prepared a recovery plan that calls for enhancement of existing populations and establishment of new populations within its existing range.

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Natural Diversity Data Base. 1998. Database search for Erysimum capittaum ssp. angustatum. California. Department of Fish and Game. Sacramento, CA.

PINE HILL FLANNELBUSH *(Fremontodendron decumbens)*

Legal Status. Pine Hill flannelbush is state listed as rare under the California Native Plant Protection Act, as endangered under the federal Endangered Species Act, and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Pine Hill flannelbush is a shrub endemic to Pine Hill and the nearby foothills of the Sierra Nevada in El Dorado County. Since it was first described in 1965, six sightings have been reported. The largest population is found on California Department of Fish and Game's (DFG's) Pine Hill Ecological Reserve, and the species also occurs nearby on private lands, although plants have been lost to construction of homes and access roads (California Department of Fish and Game 1999). Pine Hill flannelbush occurs in one localized area in western El Dorado County, where it is scattered over an area of approximately 5,000 acres (59 FR [76]:18774–18783, April 20, 1994). The overall trend for the species is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Pine Hill flannelbush occurs or has potential to occur in the American River Basin and Eastside Delta Tributaries Ecological Zones.

Life History and Habitat Requirements. Pine Hill flannelbush is a branched, spreading shrub in the cocoa family (Sterculiaceae) that grows to 4 feet tall. Pine Hill flannelbush occurs in chaparral and oak woodlands on reddish-brown clay soil derived from gabbro, a type of igneous rock. It is typically found on rocky ridges in association with chamise and manzanitas. The shrubs bear showy light-orange to reddish-brown flowers from late April to early June (59 FR [76]:18774–18783, April 20, 1994).

Reasons for Decline. The decline of the Pine Hill flannelbush may be attributed to the clearing of vegetation along ridges for firebreaks and fire suppression. It is believed that the species depends on fire to stimulate seed germination and resprouting. Residential development continues to threaten remaining populations (California Department of Fish and Game 1992). The proximity of remaining populations to human population centers has rendered the shrubs susceptible to the long-term effects of fire suppression and its restricted distribution makes the species vulnerable to catastrophic events such as disease, pests, and drought. Additional threats include residential and commercial development, unregulated grading, inadequate regulatory mechanisms, and trash dumping (59 FR [76]:18774–18783, April 20, 1994).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A draft recovery plan for the species has been prepared by the U.S. Fish and Wildlife Service (USFWS) (64 FR 11035–11036, March 8, 1999).

A-000614

Citations

California Department of Fish and Game. 1992. Annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

_____. 1999. Draft sections from 1998 annual report on the status of California state- listed threatened and endangered animals and plants. Sacramento, CA.

EL DORADO BEDSTRAW *(Galium californicum* ssp. *sierrae)*

Legal Status. El Dorado bedstraw is listed as rare under the California Native Plant Protection Act, listed as endangered under the federal Endangered Species Act, and is listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. El Dorado bedstraw is a perennial herb endemic to the Pine Hill geologic formation in western El Dorado County and on the surrounding ridges to the west within approximately 2.5 miles. (59 FR [76]:18774–18783, April 20, 1994.). The species appears to have always been uncommon and limited in distribution. Ten occurrences are known, most of which are on private land (Natural Diversity Data Base 1998). The two largest populations consist of thousands of individuals. A few small El Dorado bedstraw colonies, typically 50–200 individuals, have been discovered in the last several years in Shingle Springs. The overall trend for species is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. El Dorado bedstraw occurs or has the potential to occur in the American River Basin and Eastside Delta Tributaries Ecological Zones.

Life History and Habitat Requirements. El Dorado bedstraw is a soft-hairy, perennial herb in the coffee family (Rubiaceae) with four narrow leaves at each node (Hickman 1993). The species occurs in cismontane, black oak woodland, and chaparral communities, including sites with ponderosa pine and foothill pine, on soils derived from gabbro (Natural Diversity Data Base 1998). Its pale-yellow flowers appear from May to June (Skinner and Pavlik 1994).

Reasons for Decline. Decline of the species results from residential development, firewood harvesting, fuel-load management, road construction, horse paddocking, irrigation, inadequate regulatory mechanisms, off-road-vehicle use, and recreational activities. Its restricted distribution and the limited number of individuals make the species susceptible to catastrophic events such as pest outbreak, disease infestation, severe drought, and other natural or human-caused disasters (59 FR [76]:18774–18783, April 20, 1994, Skinner and Pavlik 1994, California Department of Fish and Game 1999).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A draft recovery plan for the species has been prepared by the U.S. Fish and Wildlife Service (USFWS) (64 FR 11035–11036, March 8, 1999).

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Natural Diversity Data Base. 1998. California Department of Fish and Game. Natural Heritage Division. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

MARIN WESTERN FLAX *(Hesperolinon congestum)*

Legal Status. Marin western flax, also known as Marin dwarf-flax, is listed as threatened under the California and federal Endangered Species Acts and as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. Marin western flax is endemic to serpentine soils from Marin County south to San Mateo County, California. There are 20 existing known occurrences from Marin, San Francisco, and San Mateo Counties (California Department of Fish and Game 1999). Populations fluctuate in size from hundreds to thousands of plants (Robison and Morey 1992). Marin western flax is protected in part at The Nature Conservancy's Ring Mountain Preserve (Skinner and Pavlik 1994). The overall trend for species is one of decline (California Department of Fish and Game 1999).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Marin western flax occurs in the Suisun Marsh/North San Francisco Bay Ecological Zone.

Life History and Habitat Requirements. Marin western flax is an herbaceous annual of the flax family (Linaceae) with slender, threadlike stems, 10–40 centimeters (4–16 inches) tall. The species is found in serpentine grasslands and serpentine chaparral (Hickman 1993). The blooming period for Marin western flax is from May through July (Skinner and Pavlik 1994).

Reasons for Decline. Marin western flax is threatened by development, loss of habitat to invasive species, and trampling by livestock (Skinner and Pavlik 1994, California Department of Fish and Game 1999).

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not yet been prepared and recovery requirements have not been identified for this species.

Citations

California Department of Fish and Game. 1999. Draft sections from 1998 annual report on the status of California state-listed threatened and endangered animals and plants. Sacramento, CA.

Hickman, J. C. 1993. The Jepson manual, higher plants of California. University of California Press. Berkeley, CA.

Robison, R. A., and S. Morey. 1992. Report to the Fish and Game Commission on the status of Marin dwarf flax (Hesperolinon congestum). California Department of Fish and Game, Natural Heritage Division Status Report 92-2, unpublished. Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

CONTRA COSTA GOLDFIELDS *(Lasthenia conjugens)*

Legal Status. Contra Costa goldfields is federally listed as endangered under the federal Endangered Species Act and is listed as Category 1B by the California Native Plant Society.

Historical and Current Distribution and Status. The historical distribution of Contra Costa goldfields was considerably greater than its present distribution and extended from Mendocino to Santa Barbara Counties. Contra Costa goldfields is known from 13 populations in the Delta region of the Sacramento Valley. It now occurs at only a few locations in Solano and Napa Counties. (Natural Diversity Data Base 1998).

Distribution in the CALFED Bay-Delta Program (CALFED) Solution Area. Contra Costa goldfields occurs or has the potential to occur in the Suisun Marsh/North San Francisco Bay, West San Joaquin Basin, and Yolo Basin Ecological Zones.

Life History and Habitat Requirements. Contra Costa goldfields is an annual in the aster family (Asteraceae). It grows 10–30 centimeters tall and inhabits vernal pools and seasonally moist grassy areas. In the past, the species may have also occurred in coastal prairies. Flowering time is March–June (Skinner and Pavlik 1994, Natural Diversity Data Base 1998).

Reasons for Decline. Declines of this species are associated with the loss of vernal pools, which can be attributed to development and agriculture. Remaining threats include continued urbanization and grazing.

Designated Critical Habitat. None.

Recovery Plan and Recovery Requirements. A recovery plan has not been prepared and recovery requirements have not been identified for this species.

Citations

Natural Diversity Data Base. 1998. Database search for Lasthenia conjugens. California Department of Fish and Game: Sacramento, CA.

Skinner, M. W., and B. M. Pavlik. 1994. California Native Plant Society's inventory of rare and endangered vascular plants of California. (Special Publication No. 1.) Fifth Edition. California Native Plant Society. Sacramento, CA.

A-000620